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The Geographical Journal

Vol. LXI No. 5 May 1923

THE BAHR EL-GHAZAL AND ITS WATERWAYS

By Dr. Cuthbert Christy

Read at the Meeting of the Society, 26 March 1923.

KHARTOUM, the capital of the British Sudan, though a desert city, nevertheless controls the political destinies of some millions of people, both Nilotic and Bantu, in equatorial tropical regions a thousand miles further south, such as those inhabiting the Bahr el-Ghazal and Mongalla provinces, people quite incapable of even dreaming of any such advanced civilization as that to be found in the cathedral city on the Blue Nile.

The Bahr el-Ghazal province of the Sudan is the country reached by way of the Bahr el-Ghazal river, which joins the Upper Nile, or Bahr el-Gebel, at lake No. At one time it was a centre of the slave trade.

The " Bahrg," as the province is often called for brevity, was described a good many years ago as " a land of cranes and pygmies, of vast swamps and forests inhabited by cannibals." Even within the past few years it has been looked upon as the last place on earth to be sent to—the " Mespot " of the Sudan—a region of swamps and fever. Now, however, the province is better known and less feared ; ignorance of the correct malaria prophylaxis is less common, and I am told officials even ask to be sent there. It is off the beaten track, somewhat difficult to reach, owing to the uncleared state of its waterways, and very little information regarding it is to be found in geographical or other literature. In extent the province is nearly the size of the United Kingdom as it was.* Though by no means the largest province it contains officially a million people, nearly one-third of the total estimated population of the Sudan, and more than double that of any other province, except Darfur. According, however, to information given me recently at Wau, its administrative capital, the population of the Bahr el-Ghazal may be nearer three than one million.

Potentially the Bahr el-Ghazal in my opinion is the richest province in the Sudan, though Darfur may run it close. Besides a big population

* According to the Sudan Almanac, the total approximate area of the Sudan is 1,014,000 square miles, and the total estimated population 3,400,000.

it contains more valuable irrigable land, more fertile plain and upland, more navigable waterways, more precious and base metals, as far as known at present, more mahogany, ivory, rubber, rivers, and water, than any of the other fourteen provinces. If we add more possibilities of hydro-electric power the list of its economic riches even then is far from complete. The most conspicuous item as yet wanting is coal or oil. Its one great obvious disadvantage is its Central African position and distance from the coast, lake No being 600 miles by water from Khartoum, and Khartoum 500 miles by rail from Port Sudan on the Red Sea.

Romolo Gessi, sent by Gordon in 1879 to reconquer the Bahr el-Ghazal from the rebel slave-raider Suleiman Zubeir Bey, and by so doing help to break the Khartoum slave trade, in his absorbingly interesting book 'Seven Years in the Soudan' (1892), wrote enthusiastically: "Thanks to the richness of the soil and its great variety of natural products, until now greatly neglected, I believe that the provinces of Bahr el-Ghazal and Niam Niam will soon become the finest jewels of the Sudan . . .; they are destined," he says, "to become great commercial markets." Casati, Junker, and Schweinfurth all speak in glowing terms of the fertility and productiveness of the Bahr el-Ghazal, the former pointing out, however, the expense of transport to the sea. Wilson, a missionary who travelled through it with Dr. Felkin in 1880, says: "Under an active Government the district of the Bahr el-Ghazal would become an important source of revenue for the Power who had the good fortune to possess it."

The Bahr el-Ghazal is exceptionally well supplied with streams and rivers. Its southern and south-western boundary is the Nile–Congo divide, and from the 600 or 700 or more miles of that watershed there arise innumerable small streams, having their origin in springs in deep hollows within a few yards of the actual water-parting or in marshy areas upon it. These streams, before flowing 50 miles, have converged to form some fifteen rapid flood rivers nearly all flowing northwards. Within the next 100 miles convergence has reduced the number to eight large rivers, having a gradually widening area of alluvial grass flats on either bank, and flowing through an increasingly level bush and grass-covered country studded here and there with granite kopjes. As they leave the plains, some 150 miles from the divide, they enter a low-lying swamp area known as the Bahr el-Ghazal "Sudd Region"—one of the most important features of the province.

The Bahr el-Ghazal Sudd Region.

The Sudd Region is not merely an interminable waste of useless swamp and water inhabited by hippos, crocodiles, shoe-bills, Mrs. Grays,* and Dinkas, as it is generally supposed to be, and as indeed it

* *Cobus maria*, now more correctly known as the Nile Lechwe.

might appear to be from the view-point of a steamer traversing its waterways at high-water season. Except along its khors and winding river channels, where real swamp occurs, it is a vast area of alluvial grass flats, flooded in the rainy season, bone dry for the rest of the year. It is, moreover, strange though it may seem, probably one of the most, if not the most, densely populated districts in the Sudan, the inhabitants being chiefly Dinkas owning vast herds of cattle, with a few Nuers, Shilluks, and sub-Dinka tribes.

In extent the Bahr el-Ghazal Sudd Region is less than one-quarter of the whole Upper Sudan Sudd Region, extending eastwards into Abyssinia and as far south as Mongalla, an area which at one time must have been a huge inland lake.

How has this great change from lake to grass flats been brought about? North of Nimule, the southernmost station of the Sudan, after descending through a comparatively narrow and rocky ravine by a series of rapids—the Fola and Bedden rapids—the Nile enters this Sudd Region, coming from the great lakes in Uganda to the southward. The reduction of the velocity of the stream as the river issues from the hill country, taken in conjunction with the filtering action of the extensive expanse of papyrus, swamp grass, and ambatch in the swamp country, checks the transport northwards of that fertilizing silt so essential to Egypt, and which at present comes mainly down the Blue Nile. The same applies also to the many rivers of the Bahr el-Ghazal, with their numerous sources along hundreds of miles of the Nile–Congo watershed on the west, as well as to the rivers coming from the Abyssinian highlands on the east.

The silt derived from the granites and gneisses of Uganda, Abyssinia, and the Bahr el-Ghazal, instead therefore of being carried on to Egypt, is deposited layer by layer, year by year, on the deltaic grass flats of the Sudd Region in the Upper Sudan, with the result that the once great inland lake has become gradually silted up, as other African lakes have done and still are doing. As a further result, the White Nile's contribution to the fertilization of Egypt is now mainly vegetable, derived from the swamps, and not mineral matter.

In spring the flats of the Sudd Region are covered with straight-stemmed vivid green grass which, viewed from the deck of a river steamer, has the appearance of young wheat, and with it as a background the many herds of the beautiful Nile lechwe far and near are conspicuous objects, especially the old bucks, with their black coats and white cervical saddle. The grotesque shoe-bill, an aberrant stork, and herds of water-buck, white-eared cob, as well as elephant, stand out also at this time of year as clearly as cattle in a field.

I have walked for hours after game in this irrigated grass in the early flood season in water from a few inches to knee-deep, not cold water but warm, as warm as one could use for a tepid bath. It is astonishing how

warm this water feels although the season is not the hottest. No wonder evaporation is excessive. And I have tramped for miles over these same flats when they have been bone-dry in the very hot weather, when water was difficult to find, even by digging. In spring as one gazes over this sea of grass stretching to the horizon and dotted at intervals with anthills, a clump of bushes, or solitary tree or palm, I have been reminded of the Argentine where one may ride all day and every day for many days with nothing in sight but wheat, and here and there the roof of the Italian or other squatter's tiny house appearing above the corn, each house with its adjacent one, two or three shelters for the things that do most of the work when the time comes, the self-binding reaping machines.

If irrigated grass, why not wheat and other cereals? Why not some day millions of fadans of cotton, or perhaps miles of date palms? In the Bahr el-Gahzal alone the huge area available is greater in extent than irrigated deltaic Egypt. As each layer of silt is deposited annually on the flats their level rises, and with the help of the ubiquitous termite, on whose mounds seeds germinate and shrubs and trees acquire a holding, the region is gradually developing a scattered bush. Even now this vase expanse of irrigable land seems to be calling for intensive cultivation, but lacks, unfortunately, one essential need—an agricultural population.

The Dinkas.

The only occupation of the existing Dinka population is cattle-tending solely in their own interests. They have no thought of bartering or selling their beasts except occasionally among themselves, in such cases as marriage settlements, etc.

In appearance the Dinkas are a tall, slim race, very dark in colour. They carry long-hafted spears and hard-wood clubs fashioned like a knobkerry. They cultivate barely sufficient grain and ground nuts for their own immediate requirements, supplementing their main diet with milk and fish. They recognize no paramount chiefs, and live, not in communal villages, but in family compounds scattered far and wide, and seem to be very fond of their women.

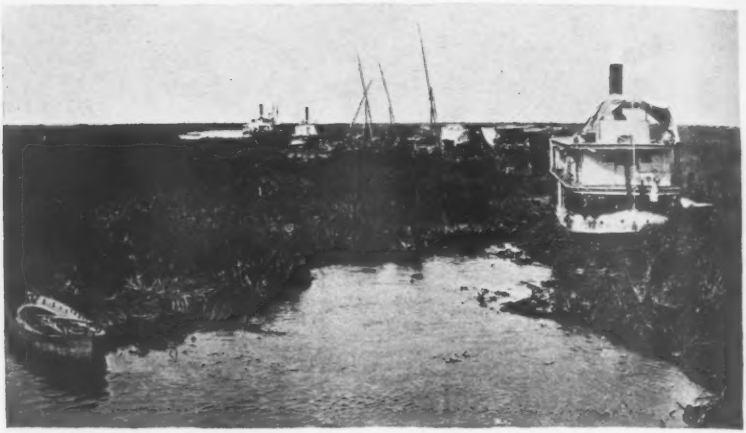
Although at one time they suffered considerably at the hands of the slave-raiders, they have, owing largely to the natural difficulties of their country, been more or less immune from invasion, which probably accounts for their enormous numbers.

Though most of the province is well known and peacefully administered, the greater part of Dinkaland is unknown, practically unadministered and quite unsurveyed, thickly inhabited areas being still marked upon the map as permanent swamp or swampy grass plain. As the raising and drying-up process on the flats continues, and the bush slowly increases and extends, the advance of the trypanosome-infected "tsetse" fly will probably one day exterminate the Dinka herds, and our descend-

PAPYRUS FRINGE AND GRASSY PLAINS BEYOND, LOWER BAHR EL GHAZAL
Phot. F. Sorel.

UPPER BAHR EL GHAZAL BLOCKED BY UMSUF SUDD FROM LAKE AMBADI
Phot. F. Sorel.

FLOODED ALLUVIAL FLATS NEAR MESHRA EL REK
Phot. F. Sorel.



STEAMERS, BARGES, AND BOATS BLOCKED IN THE UMSUF SUDD, UPPER BAHR EL GHAZAL

Phot. G. N. Morhig.

OLD COPPER WORKINGS, HOFRAT EL NAHAS

Phot. F. T. Mansfield.

OPENING UP AN OLD SHAFT, HOFRAT EL NAHAS

Phot. F. T. Mansfield.

ants possibly will observe the great pastoral tribe perforce taking gradually to agriculture, as its Atwot and other relations seem to have done in the south-east of the province where once was only swamp.

These relations are known as the sub-tribes of the Bahr el-Ghazal Dinkas—the Atwot, Shesh, Agar, and Gok. They inhabit the south and south-eastern marginal districts of the Sudd Region, about Shambe, Lau, Rumbek, and Tonj. They are already of very considerable economic interest, having forsaken the tribal occupation of cattle-tending, owing in the first instance probably to the ravages of "fly," and have become industrious agriculturists, owning miles of ground-nut and maize fields in the plains and fertile land just beyond the swamps. As a result they have lost a great deal of the barbaric habits and appearance of their swamp relatives, becoming in fact useful members of the native community, able and ready to produce hundreds of tons of ground-nuts and other grain for export, if only they were given railway facilities for transport to the Nile.

It is amongst these tribes that the peculiar custom exists of spitting in each other's faces if two friends wish to be very polite on meeting. The chiefs at least, although they comparatively rarely see a white man, have learnt, fortunately for the white man, that such an exhibition of politeness is not to his liking. The salutation of the people in roadway and field is the lifting high of the right hand with the palm forward, at the same time emitting a grunt of friendship, a relic, it always seemed to me, of days when tribal raids were common and it was necessary to be able to distinguish friends from enemies at a distance.

When by his closer association with the white man the cattle-tending swamp Dinka learns to appreciate the value of money and all that it will buy him, the pleasures of ownership other than cattle, and the stimulus of competition, his present state of savagery will vanish. No individual or tribe can stand still without risk of deterioration or extinction. Show the Dinka the way and he will soon do the rest. From what I have seen of him, I gather that he is not a person likely to be left long behind in the race. A policy, not of military but of peaceful penetration in the shape of cleared waterways for steamer and boat traffic, administrative visits and surveys, and missionary and trader influences, would, my experience tells me, soon produce peaceful prosperity, riches, and a revenue. On the other hand, if left to himself the Dinka must inevitably become an increasing anxiety to the administration and a serious hindrance to general development. That he should have been allowed to continue so long living in a state of almost complete isolation, ignorance of the outer world, in the midst of the Sudan, practically surrounded by tribes either Arab or negroid, well known, well administered and comparatively well advanced in the scale of civilization, seems to me something of a blot on the pages of Central African history. I cannot pretend to have any intimate knowledge of this extraordinary tribe. I am only

anxious to accentuate the fact that this vast number of people, though centrally placed, is at the present time so isolated, unknown, and barbarous. Instead of taking a share in the country's commerce and advancement, the Dinkas, feared perhaps because of their numbers, have until recently been severely left alone. They know practically nothing of the white man, neither administrator, missionary, nor trader. They seem, in fact, to be in the same state of barbaric paganism as they were in " Darkest Africa " days. They would well repay closer attention. Their pronounced family instincts point to the probability of their being easily amenable to civilizing influences. Hitherto they have persistently refused to engage in any kind of porterage, this being looked upon as woman's work. Signs are not wanting that they will one day become useful workers, but I doubt whether, owing to their physique, they will ever become useful porters.

General Geology.

Of the geology of Central Africa comparatively little is at present known. From what has been published it seems that the Uganda highlands are composed of a series of gneisses and crystalline schists, which form the oldest rocks known in Africa. These to a large extent are hidden beneath a thick covering of ferruginous laterite derived from their gradual decomposition under the conditions of high temperature and heavy rains prevalent in the tropics. To the north of Uganda, in the Sudan, these rocks are exposed in western Mongalla and along the Nile–Congo watershed on the one side of the Nile, and form the foundation rocks of eastern Mongalla and the Abyssinian hill system on the other side. Associated with these ancient metamorphic rocks is a series of intrusive granites, diorites, etc., forming in them dykes and veins. In the Sudan these igneous masses rise from beneath the prevailing overburden of laterite in the Bahr el-Ghazal western plains, and from under the black " cotton " soil at many places further north.

Nile–Congo Watershed.

The Nile–Congo watershed is that section of Africa's great " backbone " extending from lake Albert into Darfur. It is part of the rim of the vast Congo basin, and another most important feature of the Bahr el-Ghazal. It is very largely an ironstone divide. Its water-parting, which has an altitude of some 3000 feet above sea-level, constitutes the southern and south-western boundaries of the province. In 1916 I had the good fortune to be able to explore and map the greater portion of it, and in an article in the *Geographical Journal* in 1917 (vol. L. No. 3, Sept. 1917) I stated that, except where occasional granite masses protruded, it was a more or less continuous and narrow strip of level bush-covered laterite country, in some places a bare ironstone ridge a few yards in

width, at others perhaps 2 miles wide. Detached portions of it appear frequently as isolated flat-topped hills composed of the same honeycombed bog-iron rock, and these seem to show that in past ages the general level of the country was far higher, at any rate in the neighbourhood of the divide, than now. I also suggested that the practically continuous and level character of this divide pointed to the possibility of its being easily and cheaply utilized as a railway route, as a section, in fact, of the Cape-to-Cairo, avoiding the Sudd Region, joining up in the north with the Obeid–Khartoum line, and in the south at Nimule junction with the Uganda railway system and the Congo system.

Since my explorations in 1916 I have spent two more years in the region, and investigations into the economic geology of the Bahr-el-Ghazal have been carried out upon a considerable scale by the party I had with me.

Economic Geology.

I left Khartoum *en route* for the Bahr el-Ghazal in January 1921 with an expedition consisting of a geologist, prospectors, and a mining engineer. The usual route from the Nile viâ the Ghazal river to Meshra el-Rek and Wau was unfortunately at that time blocked by sudd, so that it was impossible to reach Wau by water. Consequently I was obliged to take the expedition 850 miles up river to Shambe on the Upper Nile, from whence we travelled overland by Rumbek and Tonj to Wau, a further distance of 265 miles. As the first part of this route is through Dinka country it was impossible to obtain sufficient porters for our 300 loads. I therefore had to obtain within about a week in Khartoum 130 donkeys with drivers, saddles, and other equipment, and fodder for a ten days' voyage. All had to be loaded on to double-decked barges and conveyed up river.

The trek from Shambe to Wau will long be remembered by all of us. The necessity, when travelling with donkeys, of moving by night in the hot weather, starting at 3 or 4 a.m.; the great heat; the scarcity and peasoup-like appearance of most of the drinking-water on the way; the choking clouds of dust, and the smoke from the long line of flaring grass torches; the shouts of the drivers; the refractory animals; the tale of casualties, cast loads, and runaways, stampeded on two occasions by lions; and the unsuitableness for donkey transport of the venesta three-ply boxes and our personal equipment, which had to be tied up into loads each morning almost in the dark, all combined to make the march night after night a strenuous and exciting one. I regret I cannot on this occasion say more of our excitements, escapes, and losses on that journey.

The country we travelled through is a bush country. Though no doubt covered at one time like the rest of Africa with primeval high forest, there exists to-day no real rain-forest in the Bahr el-Ghazal,

though in many parts the bush is well wooded, especially towards the watershed. Excepting the Sudd Region, all the Bahr el-Ghazal is covered with bush of varying density and grass, throughout which are scattered here and there large trees of economic value. Of these the mahogany (*Khaya Senegalensis*) is the most important, and in some of the watershed districts the commonest timber tree, but it never grows to the great size that it does in the forest. The mahogany is one of the very few forest trees able to thrive in bush surroundings. Since the rain-forests have long since disappeared, and an entirely different and drier type of vegetation, to some extent fire-resistant, taken their place, the annual grass fires which rage through the country at the advent of the dry season do comparatively little harm, but serve to open up native communications, produce green feed for cattle and wild animals, and allow of the latter being hunted successfully.

Hofrat el-Nahas.

From Wau my expedition made its way north-westward through Deim Zubeir and Raga to the upland districts of Kafia Kengi and the southern boundary of Darfur, with the object of exploring the region of the old copper-mines of Hofrat el-Nahas (meaning the place of the copper holes) on the Umbelasha river.

Natives, notably the Koreish-Hofrawi, probably for generations have worked these mines until quite recent times. Copper "in round pieces a foot across and 1 to 2 inches thick," or in the form of rings weighing from 10 to 12 pounds, or in small ingots, derived from this deposit, was at one time an article of barter in Darfur and Kordofan. The copper-mines of Hofrat el-Nahas are very frequently mentioned in the history of this region. John Purdy, in his account of them in 1876, states that the vein of ore at that time was visible 2 feet above the surface for a considerable distance, and that the village was half a mile from the river, "the copper-mines," he says, "so famous in the Sudan being south-west of the village at a distance of one kilometre." The mines must have been worked till the Mahdist rebellion about 1885, for old Sultan Hagar and a brother of Sultan Morad, who are both still living in the Kafia Kengi district, described to me many of the mining details from their personal recollections. Though no ruins of any village are now to be seen at Hofrat, there are the remains of two large circular forts about 100 yards in diameter standing close together and near the Umbelasha, between it and the workings, and Sultan Hagar and others asserted that these were built by the Koreish Hofrani in which to defend themselves against the slave-raiders and Mahdists, who in the end were too strong for them, and they had to retire to Guku near the old site of Kafia Kengi about 50 miles south.

Twenty-four years later, subsequent to the conquest of the Khalifa Adbulla at Omdurman, and Kitchener's hurried and dramatic voyage

up river to confront Marchand at Fashoda, Lieut.-Colonel Sparkes was sent (1900) by the Sirdar, General Sir Reginald Wingate, to occupy the Bahr el-Ghazal and the forts and stations which the French had taken over from the Belgians. During his tour Colonel Sparkes visited Hofrat el-Nahas and was the first to bring to Khartoum samples of the malachite ore.

On arrival at Hofrat we found that the old workings covered an area of over half a square mile and consisted of nearly a thousand shafts, then practically all fallen in, and several great pits surrounded by extensive dumps. Mr. F. T. Mansfield,* the expedition geologist, reported that the mode of occurrence of this copper deposit was a lode or vein system in a complex of basic, igneous, and acid dyke rocks of archæan age, and that the ore occurred in ferruginous quartz veins and veinlets in shattered aplite-schorl rock with gossan outcrops, the ore being chiefly carbonate of copper. Shafts were sunk by our engineer, Mr. A. P. Thomson, and at a depth of nearly 100 feet pyrites and chalcocite were encountered, and the main lode proved to be about 50 feet wide. Further exploration resulted in the discovery of additional outcrops of a similar kind, extending to a spot about 45 miles from Hofrat along the same strike as the main old workings. Some of these outcrops had also been worked by natives at some time or other. Throughout the old mine and some of the connected outcrops along the same strike the malachite and ferruginous quartz ores were found to carry native gold in a finely disseminated state.

Dotted all over the country round about the mine and on both sides of the Umbelasha are to be seen what look like old antheaps devoid of vegetation, but on examination these were found to be the remains of earthen smelting furnaces. In many of these the base of the smelter is still intact. Around all of them, even where miles away from the mine, can be picked up pieces of green malachite ore, and gold can be panned from the surroundings. The native workmen either failed to realize that the ore contained anything but copper, or knew no way of separating the metals successfully. Besides these old smelters, there are other evidences of there having been a very considerable and busy population in the neighbourhood perhaps thirty or forty years ago.

In the same region there exist large deposits of massive specular iron ore, in some cases highly magnetic, which have been worked by the natives for generations.

At Gebel Sombio in the Migi Hills south of Kafia Kengi, extensive old cave mines were explored, although the natives were very unwilling at first to allow them to be examined. In them were discovered antiquated iron hoes and mining tools quite unlike any implements of the sort used

* Mr. Mansfield had to return home through ill health, and died soon after his arrival in England. He was one of the best men of his year at the Royal School of Mines, and as geologist and photographer he did extremely good work. His death was a blow to the expedition and deeply regretted by all of us.

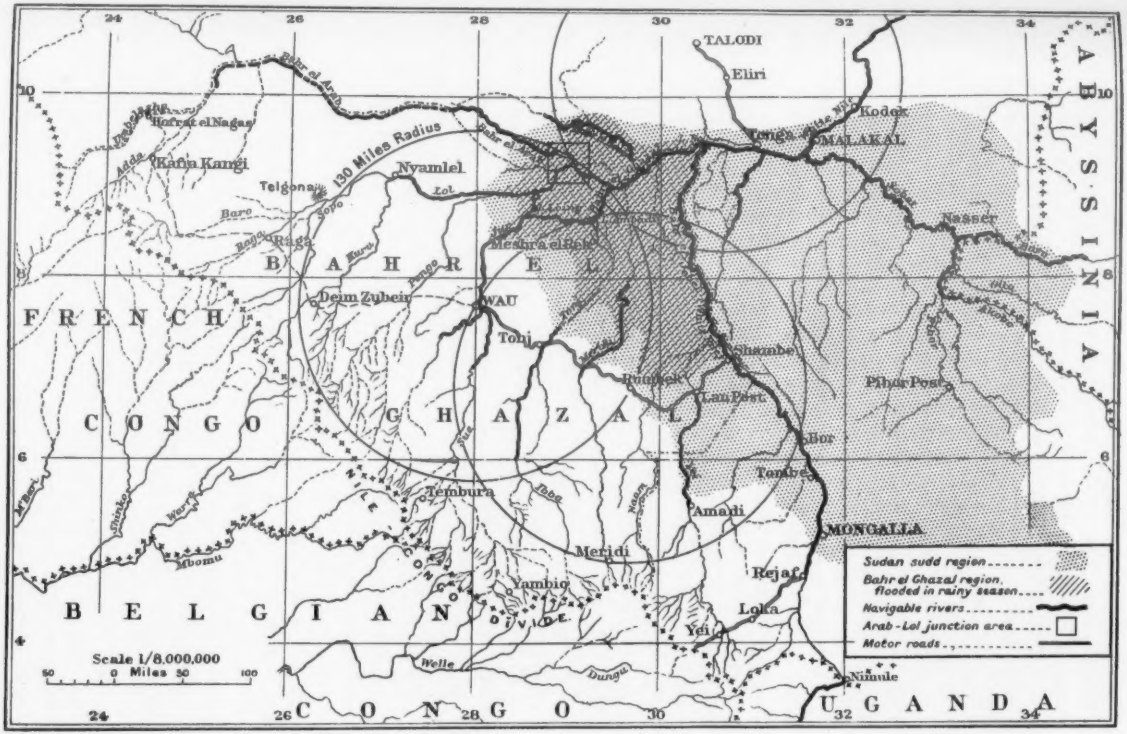
to-day. Rock caves are said to exist in the Mangaiyat hills, a large cluster of granite kopjes about five days south of Raga, but none was found by the prospectors of the expedition. Caves in the bog-iron rock, and old native iron-mine excavations, are not uncommon at a number of places along the divide. South-west of Gebel Migi and west of Said Buldas there are several, one of which, according to old Sultan Said Buldas, "was entered at the side of a hill, and by means of a narrow passage up the inside a watchman was enabled to come out on the top of the hill on to a rock from whence there was an extensive view of the surrounding country." South-west of Deim Zubeir Mr. Thomson reported numerous bog-iron caves at a spot where the escarpment of the divide "was 50 feet high for 12 miles or more." In some of these excavations he found sleeping-places, pieces of broken earthenware, and old grinding stones.

The prospectors under Mr. J. A. Chennells discovered tin (cassiterite) and asbestos in the region, and alluvial gold in certain rivers and many of their tributaries, in some places in paying quantities. Reef gold was also located. It seems, therefore, that the region is a highly mineralized one, and further explorations are now being carried out by several experienced inspectors.

The importance of these discoveries is enhanced by the fact that they are near the route now generally recognized as the one which must be taken by any extension southwards of the Khartoum–El Obeid railway.

Navigable Waterways.

Yet another most important feature of the Bahr el-Ghazal is its liberal supply of navigable waterways. Without counting the Bahr el-Gebel on its eastern boundary, there are probably in this wonderful province about 1000 miles of waterways navigable for large and small steamers, either throughout the year or for the three or four flood-season months from July to October. Of these waterways at present only some 300 miles are utilized, namely, about 150 map miles on the Ghazal river, from lake No to lake Ambadi and Meshra el-Rek, available at all seasons, and about the same distance from the Jur mouth in lake Ambadi to Wau, available only during the short flood season. When the state of the Jur river makes direct navigation impossible, Meshra el-Rek becomes the river port for Wau, 107 miles distant. Between the two places is an indifferent cart road flooded all the wet season, but so dry in the hot as to make animal transport along it difficult. Gessi was apparently the first to prove that the Jur or Wau river was navigable, for he writes in 1879: "I lately had a boat built at Wau of forty tons burden which I loaded with 709 elephants' tusks, and the boat reached Meshra el-Rek without difficulty. To send the above quantity of ivory," he says, "by land I should have had to employ more than a thousand porters."



1. The Waterways of the Bahr el-Ghazal.

Navigation to Wau by way of the Jur river is carried on under the greatest difficulties largely due to the peculiarities of the river itself, which in places is extremely narrow and tortuous, In every few hundred yards the channel takes several sharp curves and S-bends, round which steamers and barges in their upward passage against a fairly strong current have to be tugged and warped at a cost of much labour and fuel, often progressing no more than half a mile a day. Occasionally many steamers, tugs, and barges are blocked for weeks at a time and even months. The narrowest part of the Jur is a section of about 5 miles some 20 miles from lake Ambadi. This section is usually referred to as " the narrows." Throughout it the tortuous channel is no more than 20 to 25 feet in width, and for 10 or 15 map miles is scarcely 30 feet wide.

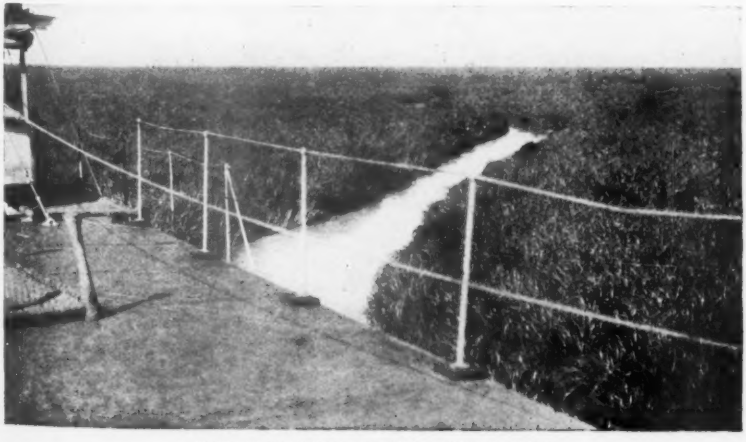
To supply the troops at Wau with stores, equipment, and grain, and to get up to that station even a small portion of the trade and other goods requiring transport during the short high-water season, not to mention passenger traffic which is considerable, requires the united efforts of an army of men, half a dozen tugs, four or five large and small stern-wheel steamers, and fifty or sixty barges, a large number of the latter being occupied in carrying wood fuel. Nearly all these are in the river at one time, most of them in the " narrows," and all have to be got out again before the water-level falls. The wear and tear, the waste of men and fuel, of time and money, necessitated by keeping open such a waterway is of course excessive.

To improve the navigation of the Jur " narrows " by canalization would not in my opinion be practicable. Any such canal would need to be about 20 miles in length. The fall during that distance is considerable, to judge by the rapidity of the current when the stream is confined to the channel before flooding commences. The results of canalization would probably be (1) to so lower the level of the river above any such canal that navigation to Wau would be no longer possible ; (2) to greatly lessen the extent of the irrigated area on either side of and below the canal, since it is the extreme tortuosity of the narrow section of the river which now holds up the flood water, and causes it to spill over so wide an extent of grass flats ; and (3) to cause the arrival in lake Ambadi early in the flood season of a greatly increased volume of water, which, if it had any effect at all, would probably result in moving quantities of fugitive lake sudd, which would tend to block the Ghazal river early, as well as late in the season as it does now.

In flood-time the waters of the Jur river are very heavily loaded with dark reddish silt, the colour being largely due to its iron constituent probably. The water looks like strong cocoa and is about the same colour. Before it can be run off from one's bath on board the steamer, it leaves a chocolate deposit perhaps a quarter of an inch deep. Soon after reaching Ghabat el-Warrana on the way down the river the overflow water in high flood season may be seen rushing through every open-

DONKEY TRANSPORT, NORTH-WESTERN BAHR EL GHAZAL
Phot. F. T. Mansfield.

SULTANI DORUMA AND HIS FAMILY, S.W. BAHR EL GHAZAL
Phot. C. Christy.



THE NARROWS OF THE JUR RIVER
Phot. A. P. Thomson.

FLOATING UMSUF SUDD ON THE LOWER BAHR EL GHAZAL
Phot. F. Sorel.

DREDGERS NEAR MESHRA EL REK OPENING UP THE KHOR KO
Phot. F. Sorel.

THE KHOR KO NEAR MESHRA EL REK OPENED TO NAVIGATION
Phot. F. Sorel.

ing from the channel out into the surrounding flats, mainly to the northward, and from this alone it seems probable that the bulk of the waters of the Jur flow into the Lol and so reach the Arab river. As additional evidence of this, and as a good illustration of the filtering action of the grass on the flats, I may mention that beyond this spot the water begins to clear, and below the "narrows" before reaching lake Ambadi it has become almost clear and the current considerably diminished.

On the banks of the Jur river above the "narrows" lions are frequently shot from the deck of the steamer* towards evening or in the early morning. Game is plentiful, white-eared cob, water-buck, and giraffe often being in view at one time.

Sudd Blocks and their Treatment.

The several hundred miles of unused waterways in the Bahr el-Ghazal have hitherto not been available for navigation owing to some portions of them being blocked with sudd, or their outlets to the Ghazal river or to the Nile being unknown.

Sudd, the word meaning "block" in Arabic, is of two descriptions: one a peat-like formation, up to 8 or 10 feet in thickness, composed of papyrus roots and rotting vegetation; the other consists of masses, 3 to 5 feet thick, of the tangled and rotting roots and stems of a species of *pennisetum* grass known in Arabic as "umsuf." Papyrus sudd is to be seen on the Bahr el-Gebel, which at one time was completely blocked to navigation by it, but to-day is a fine waterway, with regular steamer traffic, deeper, less tortuous, wider, and far more easily navigable than when I first passed along it soon after it was cleared in 1902. The "umsuf" sudd, both fixed and fugitive, is the main cause of the blocking of the rivers of the Bahr el-Ghazal, where very little papyrus is to be found. Coming up the Ghazal river it ceases before reaching Ghabat el-Arab, and thereafter is only met with in small patches here and there.

Cutting a channel through papyrus sudd even 10 feet thick, though a big undertaking as regards the time, men, steamers, and fuel, is comparatively simple work, sections of the mass being cut or sawn through, then detached, tugged downstream, and allowed to float away or break up. "Umsuf" sudd, on the other hand, is less easy to deal with, being too strong and fibrous to cut up and be floated away by the current. Its treatment needs a special study on the spot. In most places a grab dredger fitted with an extra long arm and light and large bucket could probably accomplish all that is necessary. Navigation from lake Ambadi to Meshra el-Rek, always troublesome owing to masses of fugitive sudd blocking the passage-way, has recently been greatly improved by opening up a diverting khor leading to Meshra by the use of

* Lions, of course, are vermin. It is, I am glad to say, forbidden to shoot the game animals from the steamers.

a grab dredger for clearing the passage of sudd, the dredged material being dropped on either side of the channel. The efficiency of the grab dredger might perhaps be enhanced if some form of ship's derrick could be rigged to enable the bucket contents to be dropped beyond the reach of the dredger arm, for hitherto it has been found that if the material is dumped too near, even if apparently fixed by dredged soil being placed on the top of it, decay and the evolution of gases soon tend to loosen it and allow it to slide back into the channel, there being frequently no solid banks to place it upon.

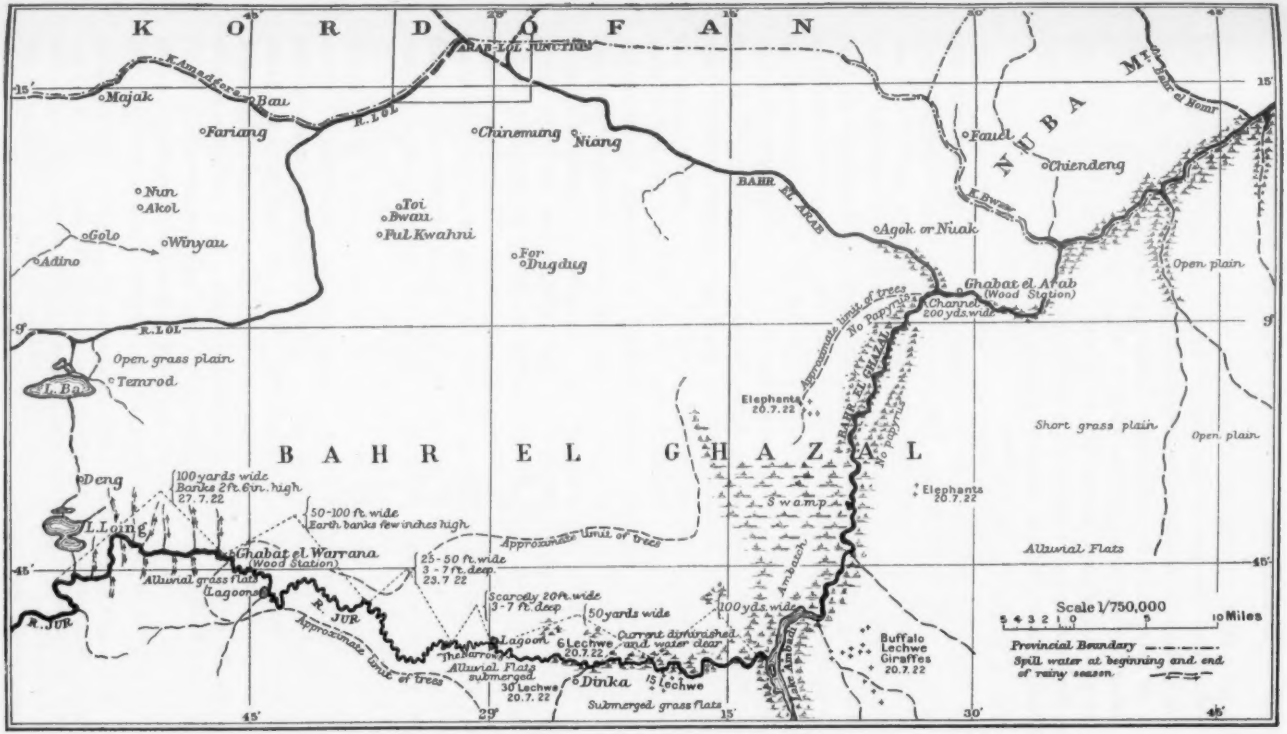
The Bahr el-Ghazal River.

The sudding of this Bahr el-Ghazal river between lake Ambadi and Ghabat el-Arab is entirely caused by fugitive lake sudd entering it. I say entirely because I am convinced after careful observation at different seasons that it is so. The block begins annually at the same place, the north end of Umbadi where the river leaves the lake. During the early part of the flood season in a normal year before the water has loosened the sudd, this river, as is well known, is clear and navigation easy. Gessi, travelling up it in June 1874, "found no great difficulty from floating obstructions"; and again in July he records that it took his steamer only eight days to get from Meshra to Shambe. In August, under the influence of high water and heavy storms, islands of floating sudd became detached and difficulties commenced. The conditions were precisely the same in 1880, for on September 25, while navigating lake Umbadi *en route* for Khartoum on board the *Safia*, Gessi writes: "We passed the place where the Jur flows into the Bahr el-Ghazal and are stopped in front of a bar of vegetable matter about 5000 feet long." On that ill-fated occasion Gessi's party was too late in the season. After working his way as far as Ghabat el-Arab he was blocked in the Ghazal river for over three months, two or three hundred of the people on the steamers and boats with him dying of starvation.

The crux of the problem is to prevent the floating fugitive sudd, blown hither and thither on lake Umbadi by the wind, from entering the river and corking up the lake outlet. This happens annually soon after the water has reached its highest flood-level.

The depth of water in the lagoons and areas partially covered with floating vegetation in this region is only a few feet, perhaps 7 or 8 at the most, 2 or 3 only at low-water season, and it is very probable, in lake Ambadi at all events, that a system of staking and wiring could be evolved which would effectively prevent migration of the fugitive masses. This has, I understand, been tried with partial success, but the supports put in were not of sufficient strength to withstand the pressure of the floating mass under storm conditions.

Before leaving the subject of the Ghazal river it may be of interest to note the apparent decrease in the numbers of hippopotami since



2. The junction of the Bahr el-Ghazal and Bahr el-Arab (covering the region enclosed in rectangle on Map 1).

Gessi's time. He says: "Hippos in immense numbers fled on every side before the prow of the vessel. They could not turn back because the space was insufficient, and they were obliged to swim before us with a velocity which was surprising, being against the current. One beast swam in front of us for five hours." Now one sees comparatively few hippos in this river, and so also in the Jur. In the Jur "narrows" they have learnt to pass beneath the steamer, although there would seem sometimes to be only a few inches to spare.

The Arab and Lol Rivers.

The most important of the unused waterways are the Arab river and the Lol, its tributary. The Bahr el-Arab—Bahr meaning "river," of course—is about 400 miles in length. Though a good deal is now known about the course of the Arab, formed by the junction of the Adda and the Umbelasha, the greater part of it has never yet been navigated owing to the existence of extensive swamps at the Arab–Lol junction, about 40 miles from Ghabat el-Arab where the river is supposed to join the Ghazal river. A passage-way has never yet been discovered through these swamps. No successful attempt to explore the blocked section has been made since 1906, when Commander Huntley Walsh of the Steamers and Boats Department, Sudan Government, was sent to the region during February and March with the steamer *Beatrice*, which draws 3 feet 3 inches when loaded. It was then the dry season, and to traverse the first 19 miles from Ghabat el-Arab he was obliged to lighten his steamer until she drew only 2 feet 11 inches. Thereafter he found the channel consisted for a few miles of open water alternating with small sudd blocks, the river being 80 to 100 yards broad, 20 feet deep, and having a current of $\frac{1}{8}$ mile per hour. He then encountered 13 or 14 miles of navigable water, the river being 80 to 400 yards broad with a depth of 18 to 20 feet, and a considerable current; after which he was stopped by sudd near the Arab–Lol junction about 40 miles from his starting-point on the Ghazal river.

He reported the sudd blocks at the junction to be 2 or 3 miles in extent, "at first hard but in the upper part not very heavy." * From that point he left the steamer and travelled up the north bank, reporting that the river as far as Sheik Lar was open, very deep, from 100 to 200 yards broad, and clear of obstruction from that place to Sheik Rob's, about 50 miles above the Arab–Lol junction. It is not clear whether Huntley Walsh went further than Sheik Rob's, for the site of this chief's village has been changed, but he states that above that place the river is of a different character, being 12 to 30 yards broad, with high banks,

* The only copy of Huntley Walsh's brief report to which I have had access through the courtesy of the Director of Intelligence in Khartoum is the printed one. In it the extent of the Sudd block at the Arab–Lol Junction is given as 23 miles. This I feel sure is an error of printer or typist, and should read 2 or 3 miles, for 23 does not agree with what follows.

a minimum depth of 5 feet (at that date several feet below its average flood-level), a current of 1 or 1½ knots per hour, and no sudd. Its course was very winding and big trees grew along its banks. He thinks, his report says, from what he has seen and learnt, that the river is navigable, possibly throughout the year, but certainly in the flood season, for over 100 miles above the Lol junction, or about 150 miles from where it enters the Ghazal river. From information gathered he concludes that it is probably navigable in its upper parts as well, another 250 miles. It still remains for future exploration to determine whether he was right, and to what extent these 250 miles are really navigable.

I have been unable to find any record of any one having followed the course of this river for any distance above the section reported upon by Huntley Walsh, between meridians 26 and 28, but statements of those who have crossed it at various places along this reach point also to its being navigable. Gessi on his way north to meet Gordon at Darra in the Shakka district, shortly before the final overthrow and death of Sulieman, says: "On the fourth day after our departure from Delgauna we approached the Bahr el-Arab, but before reaching its banks we crossed a valley about 3 miles wide which at this season was perfectly dry, but which during the rains receives the overflowings of the river and becomes a great impassable marsh. The banks of this river, which are deserted during the rains owing to the flooding, become populated in summer. More than a hundred thousand cattle and sheep," he says, "are brought to the rich pastures from Rizigat, Shakka, and Kalaka."

On his return journey south soon after, Gessi says: "From Kalaka I went to the Bahr el-Arab, the banks of which we reached in four days. The water was deep and the breadth of the river about 700 feet. Both shores were covered with thick forest containing many *dulep* trees. We set to work to make light rafts with dried canes, and pushed by good swimmers we were transported to the opposite shore. Those who could not swim clung to the sides of the raft, and in this way we carried across ten persons at a time. It took four days for the whole party to cross."

Felkin and Wilson, travelling between Raga and Kalaka on their journey from Uganda, crossed it a little below the Umbelasha–Adda junction on 19 December 1899, and reported the channel to be 360 feet broad, with 3 feet of water and banks 15 feet high.

Captain Wilkins of the Egyptian Army, stationed at Nyala, recently followed the course of the river between meridians 26 and 25. He has stated, I understand, that in this region it is 80 to 100 yards wide, with high banks and sandy bottom, with no sign of rocks or sudd, and flows in a series of S-bends. From this and from what I myself have seen of the character of the Umbelasha and Adda rivers near their junction, I conjecture that Huntley Walsh's conclusions are correct, namely, that the river is probably navigable during flood season in its upper parts,

and very likely as far as the Umbelasha–Adda junction. Further exploration is obviously needed to decide this point.

As evidence of the date of the commencement of the flood season on this river, the following perhaps is of interest: On 2nd May 1921 the Umbelasha at our Hofrat camp contained only a trickle of running water; on May 10 it came down in spate with much noise and froth over dry sand, and in an hour was 2 feet deep; on 27th the water was only 18 inches deep, but a week later was unfordable on foot and very thick.

The Lol river at the Arab–Lol junction, according to Huntley Walsh's report, was found to be very deep, the current strong (2 or 3 knots), and its width 400 to 500 yards. It was then towards the end of the dry season. As far as could be seen the channel was sudded up, but "the sudd did not look very heavy," he says. Beyond this block the Lol river has, since 1906, been explored westward,* and is known to be a good navigable waterway as far as Nyamlel, approximately 150 (map) miles from the Arab–Lol junction, and if it were not for some rocks near that place, said to be easily removable, navigation could be continued in flood season as far as Telgona (Jebel Delganna), some 60 or more miles further, reaching a spot about 50 miles from Raga and 130 from Kafia Kengi direct.

True Outlet of the Arab River.

A statement of considerable interest in Huntley Walsh's report is that the current of the Lol even in March was very strong, and coming at right angles to the Arab at the junction, loses itself towards the north in swamps and open water, while, as I have already stated, he reported that the ultimate 19 miles of the Arab before it reaches the Ghazal river is less than 3 feet deep and has a current of only $\frac{1}{8}$ of a mile per hour. The two statements are very significant. When I was at Ghabat el-Arab this year, as late in the season as the beginning of August, there was no current at all, the water in the supposed mouth of the Arab looking as if it were stagnant. Native reports made to me on that and other occasions seemed to confirm most of Huntley Walsh's statements relating to the Arab–Lol junction area. Everything so far, in fact, seems to point to the possibility of the real outlet of the Arab river being not at Ghabat el-Arab at all, but somewhere further to the north.

The country to the north of the Arab–Lol junction is unexplored and practically unknown. A reference to the map will show at once what great possibilities of discovery there are in the region. The natives speak of large patches of open water. These are also mentioned by Huntley Walsh. Beyond we have the Bahr el-Homr as yet unnavigated and unexplored, as well as large khors, any of which, if not the Bahr el-Homr, might turn out to be the Bahr el-Arab.

* Exploration carried out by Miralai H. F. O. Thwaites Bey, M.C. Director Military Works Dept., Khartoum, and others.

Besides the Umbelasha and Adda rivers the Arab receives two or three very large khors flowing only in the rainy seasons and draining the southern half of Darfur. Its tributary, the Lol, receives the Pongo, and, as I have pointed out, most of the spill-water apparently of the much larger river the Jur. These latter rivers drain some 500 miles or more of the Nile–Congo watershed from Yambio to Kafia Kengi. It seems, therefore, inconceivable that the flood waters from so vast a drainage area should lose themselves in the swamps of the Arab–Lol junction as suggested by Huntley Walsh. It may be said, of course, that of all the water from the equatorial lakes entering the Sudd Region by way of the Fola and Bedden rapids only about one-third passes lake No, the remainder being spread over the grass flats and swamps or evaporated. It would be interesting to know what relation the total volume of flood water coming from so enormous a catchment area bears to the volume coming into the Sudd Region from the equatorial lakes. In any case it is very doubtful whether the true outlet of the Arab river is at Ghabat el-Arab. In all probability it is further to the north. Exploration should easily determine the matter.

Alternative Route to Wau.

To return to the river Jur: Between the Jur and the Lol are a number of large open-water areas, big shallow lakes in fact, one of which is named lake Loing.

As long ago as 1910 the then Controller of the Sudan Government Steamers and Boats Department suggested that there might exist a passage-way for steamers from the Jur into the Lol through lake Loing, and that if such a passage could be found it was possible that the Lol might provide a better channel for traffic with the interior than viâ the Jur to Wau. In 1911 Huntley Walsh tried unsuccessfully to discover this passage. In 1913 a more successful attempt was made by Mr. Lubbock, who, I understand, got his steamer through to the Lol. The passage is through lake Loing and other sheets of water connected by channels or open khors. It leaves the left or north bank of the Jur 70 miles or more from Jur mouth in lake Ambadi, and a few miles above Ghabat el-Warrana wood station, when, as I have said, the overflow water in flood season may be seen rushing through every opening mainly towards the north.

If further exploration proved that this passage-way between the Jur and the Lol was easily navigable for steamers or could be made so it would, since we already know that the Lol is easily navigable to Nyamlel, afford a better transport route to the interior of the Upper Bahr el-Ghazal than viâ Wau. But unfortunately there would still remain the Jur "narrows" to be reckoned with.

If, however, steamer navigation were possible from the Arab mouth, wherever it may be, and through the Arab–Lol junction swamps into the

Lol, the above-mentioned passage-way, if easily navigable, might afford an efficient transport route, to and from Wau, in the flood-season months without passing the Jur "narrows," as well as to Nyamlel. The total distance to Wau by such a route would probably not exceed that by the present "narrows" route, and more wood-fuel could be obtained along it than is available on the existing most unsatisfactory route. What is more, such a route would avoid lake Ambadi and that section of the Ghazal river which annually becomes blocked by lake sudd.

Other Navigable Rivers.

In addition to the Arab and the Lol, the Sueh and Wau rivers, which join to form the Jur a little above Wau station, are both navigable without obstruction for considerable distances, the former probably for nearly 50 miles above the junction in flood-time. The Tonj and Meridi are both navigable for small steamers on their lower reaches during flood time and possibly for 100 miles or more, if they could be entered from Meshra el-Rek. At present the khors leading from them to the Ghazal river in the neighbourhood of Meshra are quite unexplored. The Naam and the Wau rivers also are navigable for some distance, but their outlets to the Nile in the Shambe district are unsurveyed. If passage-ways could be found or opened up by dredging into these rivers they could be utilized for the transport of produce, etc., to and from not only the stations of Tonj, Rumbek, and Mvolo, but the whole of the southern Bahr el-Ghazal.

Importance of Further Exploration.

If the Arab river were found to be navigable from the Ghazal river and therefore from the Nile, or easily made so by dredging operations, even for four months in the year, it would afford cheap transport to and from southern Darfur with its big population of Rizegat, Habania, and Taisha Arabs. The extent of the general trade that could be developed with Darfur would be limited probably only by the capacity of the transport service. So also in the case of the Lol. If it were accessible from the Arab river, or could be made so, it would, viâ Nyamlel, serve Deim Zubeir, Raga, Kafia Kengi, and the north-western Bahr el-Ghazal, a populous, extremely fertile, and mineralized region of the greatest economic importance; one moreover in which the inhabitants, though purely negroid and not Arabic, grow their own cotton, weave their own cloth, and make their own clothes.

Irrigation.

Apart altogether from the question of inland navigation there is yet another and very urgent reason for the early exploration of the Bahr el-Ghazal waterways. I refer to irrigation and the water supply of Egypt. In the report of a recent commission engaged upon the study of the Nile Water Supply, I understand that the commissioners admit

their absolute inability to form any opinion upon the part played by the Arab and Ghazal rivers and the rivers coming from the Nile–Congo watershed, owing to the total absence of information and surveys dealing with the Bahr el-Ghazal waterways and rivers, as well as details regarding all the swamp regions to the west of the Bahr el-Gebel. They recommend that such surveys should be undertaken without delay, more especially in the region of the Bahr el-Arab. A knowledge of the existing waterways in the Bahr el-Ghazal, and especially the Bahr el-Arab, must be of vital and urgent importance to the study of the White Nile water supply, more particularly to the conditions likely to have a bearing upon the working and future of the Gebel Aoli or Khartoum dam.

It has been stated that for six months, from June 1 to December 1, evaporation and rainfall practically balance each other, while for six months from December 1 to June 1 evaporation far exceeds the rainfall. The White Nile, Sir William Willcocks says, has already stored in the Sudd Region all that Egypt will need till the day of doom or the Sudan for many generations, and it is in fact no longer the Sudd Region but the Sudd reservoir.

This view, I understand, is generally accepted, and I venture upon a criticism with all due deference to Egyptian irrigation experts, claiming for myself no knowledge of irrigation whatever. I merely wish to again point out that hundreds of square miles of the Bahr el-Ghazal sudd region are not swamp but irrigated alluvial grass flats, and that real or permanent swamp in which anything like deep water exists is the exception, only to be found in the immediate proximity of the rivers and main khors. When the flats, comprising perhaps more than 95 per cent. of the Sudd Region, are bone dry from December 1 to June 1, I venture to think that, in spite of the heat, the evaporation cannot be excessive—is in fact very small. The total area therefore capable of acting as a permanent reservoir, though it is augmented in full-flood season by the water spread out over the flats, is far less probably than has hitherto been supposed.

Possibilities of Preliminary Air Survey.

There can be no question as to the urgency of acquiring a knowledge of whether, and if so at what expense, the existing waterways could be improved, especially as to whether the Arab and the Lol rivers could be made navigable for steamer traffic. That the Sudan Government are fully alive to the importance of this matter the various explorations conducted by the Department of Steamers and Boats at Khartoum, to which I have already referred, are sufficient indication. How then is this to be accomplished? Exploration with a small stern-wheel steamer needing a tug and barges to supply fuel and necessaries, having to battle its way blindly day after day through interminable acres of floating vegetation from one piece of open water to another, and from the deck of which a very limited view is obtainable, is laborious and un-

healthy work for the men, in and out of the water all day, cutting and pulling away obstructions, and heartbreaking work for the persons in charge. Most of this labour, expense, and ill health could probably be avoided by a preliminary photographic survey from aeroplanes. Photographs showing at a glance the main channels and khors and the position of open water could be produced by this means in a few days, saving months of steamer work. Such a reconnaissance could be carried out with amphibian machines based on lake No during early flood season, about May to July. If attempted during the hot dry season of January to April, when papyrus and grass fires are raging, it would be difficult to see beyond a mile or so owing to the smoke-laden atmosphere.

Lake No is approximately 110 miles from the Arab–Lol junction direct. Amply sufficient open water for working amphibian machines could be found much nearer if necessary, there being lagoons of considerable size along the course of the Ghazal river, which itself at places near Ghabet el-Arab is 200 yards wide. The Ghazal river being navigable at all times there would be no difficulty as regards accommodation for *personnel* on steamers and barges, nor in the conveyance of petrol, stores and outfit as far as Ghabat el-Arab or beyond.

Much could be accomplished with ordinary aeroplanes based first upon Eleri or Talodi, only about 50 miles north-north-west of lake No. At Eleri there is a military aerodrome, which is, I understand, being still kept in repair, and from either of these centres the block at the Arab–Lol junction, the photographing of which would of course be the first aim of any aerial survey party, is only 130 miles distant. From Wau, where a good dry aerodrome could easily be made if the survey were continued, the same sudd block and all the navigable portions of the Jur and Lol rivers, as well as Meshra el-Rek, would be within a radius of 130 miles; and from Rumbek both Meshra and the unknown areas between that place and the Nile are within the same radius. From these three points, and perhaps from Shambe, if not too swampy a landing-place, all the important Bahr el-Ghazal waterways, both used and unused, and all the surrounding annually irrigated grass country could be photographed.

There appears to be no successful method of carrying out a photographic survey from the air except by aeroplane. The captive balloon seems to be quite unsuitable owing to the twist upon its tethering rope combined with the unavoidable lateral oscillation. There is, moreover, the question of the gas supply under a tropical sun. If that difficulty could be solved, though it seems doubtful, much could no doubt be accomplished by the use of captive balloons merely as observation posts with their winding apparatus attached to a barge and power derived from an accompanying steamer. At the height of 1000 feet many miles ahead could be accurately observed, sketches made, and the expedition steamers piloted in any direction.

If the observation balloon is not feasible in the tropics there is still the alternative of raising an observer to the height of several hundred feet by means of the military box kite. Whatever means is employed, and whether a preliminary aeroplane reconnaissance is carried out or not, it seems high time that the exploration of the region of the Bahr el-Ghazal waterways should be undertaken.

Before the paper the PRESIDENT said: Our lecturer this evening, Dr. Cuthbert Christy, is no stranger to an audience of the Royal Geographical Society. His geographical work is well known to them, and, indeed, it was recognized not so very long ago by the grant of one of the Society's awards. He is a man who has travelled extensively: in the West Indies and in South America; in India and in Ceylon; and notably in Africa, where he has had personal experience of Nigeria, when he served as a member of the African Field Force there about a quarter of a century ago; of the Congo, the Gold Coast, and Cameroons; of East Africa and of Uganda and of the Sudan; and, in recent times, as a member of the Mesopotamian Expeditionary Force, he has added that country to his list. You will observe, therefore, that he is a widely travelled man. He has had great experience of tropical diseases: of plague in Bombay, where he worked with the famous Professor Haffkine, and of sleeping sickness in the Sudan and Uganda, for he was, I believe, a member of two Commissions which investigated that dire scourge. He has also had experience of malaria in East Africa. The country that he is going to describe to us to-night is, apparently, a country of great potential wealth, but one which is handicapped by its distance from the world's great highways, for it is, I believe, well over 1000 miles from the nearest ocean at Port Sudan. It possesses apparently many hundreds of miles of rivers, but of the difficulties of rendering many of them navigable the lecturer will, no doubt, speak this evening. Nevertheless, there are possibilities, and he will tell us, I think, that much exploration is still required before our knowledge of the possibilities of navigation of these rivers can be said to be adequate; and great interest will attach to the view which I understand he will express, that the easiest and quickest way in which that knowledge can be obtained will be by means of aerial survey. And that is of particular interest to the members of this Society in view of the developments in aerial phototopography which were discussed at a recent afternoon meeting, and which will appear in due course in our *Journal*. But I must ask the lecturer to speak for himself, and I have great pleasure in inviting Dr. Cuthbert Christy now to give us his lecture.

Dr. Christy then read the paper printed above, and a discussion followed.

Major THE VISCOUNT HAWARDEN: I was in the Bahr el-Ghazal Province nearly nine years, though I am afraid I really do not know as much about it as I ought to. In fact, Dr. Christy has shown me how extremely little I knew about it. It is a matter of exceeding interest, and I agree with him entirely that it is a most wonderful province with extraordinary possibilities before it. The northern Dinka part is a most extraordinary cattle country. There are millions, and almost tens of millions of cattle, and it is the best part of the whole province, because the fly has not reached there. The Dinkas have fly-free country, and they are people that the administration has been able to get in touch with very little indeed. They do not mind us, but want to be left alone. There is nothing we can offer them that they like; [they are content to be naked,

and if they want anything at all it is a little bit of brass to put round a spear, so that they are very hard to get in touch with.

As regards the rivers, I suppose it has been the hope of every inspector and governor of the Bahr el-Ghazal that the Bahr el-Arab would be opened. It is such a fine river. A Deputy-Commissioner was sent up there to meet the Deputy-Commissioner of Abu Gabra in Darfur in 1916, and he crossed the Bahr el-Arab somewhere in the north between Nyamlel and Telgona: he said it would be possible to float a battleship on the river then, when at that time the Wau river was quite fordable. I have been across it in shoes without getting my feet wet. But the Bahr el-Arab had 30 or 40 feet of water in it. It is a pity that river is allowed to go to waste.

There is one thing Dr. Cuthbert Christy said about which I am not sure: as to the water going north towards the Lol out of the Jur river, and where it gets into the Bahr el-Ghazal. I must have noticed it, but I have been in the river a good many times and at most seasons of the year and in flood-time, and I was under the impression that it went both ways. It is so flat there that it spilled out and did not go merely to the north. Undoubtedly there is a very large river—it may be the Bahr el-Homr, right up in the north—which the Bahr el-Arab goes into. As Dr. Christy says, it is inconceivable that all the water coming down from the Nile-Congo border should be lost in a mere swamp, and that swamp without a current.

As regards game, I have been told that between Bahr el-Ghazal and the mountains up by Eliri way, the game is either on the river itself or right up at the foot of the Eliri range, and that there is an enormous khor there. It may be the river itself. One does not know. I have not been up there. I suppose it would be quite possible to see it from an aeroplane, but it would be difficult. Then, of course, the other rivers Dr. Christy barely touched on; they are navigable too. One knows that an enormous volume of water comes down the rivers one crosses between Shambe and Tong; they are great torrents in the rains, and inspectors have been down the rivers and on to the end of the Sudd.

The PRESIDENT: Sir Edgar Bonham-Carter, who was Legal Adviser to the Sudan Government for eighteen years, is here; perhaps he would like to add a few words.

Sir EDGAR BONHAM-CARTER: The lecture has been extremely interesting to me, having lived in the Sudan for long, and having many years ago travelled over part of the route which the lecturer has described. It has interested me for another reason. His description of the copper-mines at Hofra-en-Nehas reminds me of one of the first negotiations in which I was engaged for the Sudan Government.

When in 1899 I was appointed by Lord Kitchener Legal Adviser to the Sudan Government, he told me my first duty would be to prepare some mining laws and to enter into negotiation with a number of people who wanted mining concessions. This I proceeded to do. When I got out to Cairo I was approached by a man who wanted a concession. He represented an important firm of mining engineers in London, and came to me with a mysterious air, saying he had some exclusive information with regard to mines, which he would divulge to me on condition that I would keep it entirely secret. He then proceeded to tell me that this exclusive information related to the existence of copper in the Bahr el-Ghazal at a place called Hofra-en-Nahas. As Dr. Christy has already informed you, Hofra-en-Nahas is Arabic for "the copper hole." So the exclusive and secret information of my mysterious friend could be learnt by any one who had a smattering of Arabic and looked at a map. The existence

of the copper-mines at Hofra-en-Nahas was even then well known to any one who had studied the literature of the Bahr el-Ghazal, though few Europeans had visited them, and owing to the Mahdist rebellion no European had visited them for many years.

Dr. Christy has also described the agricultural possibilities of the Bahr el-Ghazal. In one sense the Sudan has been developed in a topsy-turvy manner, because it was necessary to develop first the northern part of the country since it is nearer to the sea and is accessible by railway. But the northern part of the Sudan is practically rainless, so that only such parts of it as can be irrigated from the river are capable of agricultural development, and the great mass must always remain desert. In the Bahr el-Ghazal, on the other hand, as in other southern parts of the Sudan, there is a very good rainfall. The agricultural possibilities of the Bahr el-Ghazal are undoubtedly considerable. But I find some difficulty in following Dr. Cuthbert Christy in thinking that it can successfully grow such crops as cotton. For the rainy season is confined to a few months of the year and there is a long rainless season. There is too much rain during part of the year, and much of the country becomes a swamp. On the other hand, during the latter part of the dry season, except in the river-beds there is difficulty in getting water even for drinking. Owing to the impermeable character of the soil, the rain instead of sinking in lies on the surface and eventually evaporates. The wells are shallow, and are liable to dry up, and the water from them is very disagreeable and nasty.

There is one thing which I think is appropriate to add to Dr. Christy's interesting lecture. I remember all the officers who went into the Bahr el-Ghazal Province in early days immediately after the reoccupation of the Sudan, when nothing was known about it except the descriptions in books written by Gessi, Schweinfurth, and others. There were Colonel Sparkes, Colonel Hunter, Major Boulnois, and many another fine officer. They entered the country at the risk of their lives, not so much from warfare, though there was that risk, but from fever and the dangers of travel in an unmapped and unhealthy country, They had often to wade day after day through swamp. There were no houses: no resthouses. They did their work. And now there is hardly one of them left. They nearly all died, either in the country or within a few years after leaving it. We owe a very great debt of gratitude to them, and their names should not be forgotten at a lecture on the Bahr el-Ghazal region.

Colonel LYONS: I have listened to Dr. Christy's lecture with very great interest, and the more so as I cannot claim any personal knowledge of the Bahr el-Ghazal area other than of its lower reaches. I was glad too, from a geographical point of view, that Dr. Christy laid stress on the fact that the whole of that large area is not a continuous marsh, but that the marsh areas are restricted to the shallow valleys of the rivers which traverse it, and beyond them, except in the rainy season, the intervening areas are largely dry. This has been pointed out even by the earliest travellers in the region, but for some reason or another the idea of vast illimitable marshes has caught the fancy and seems to be ineradicably rooted in many descriptions of the Upper Nile.

Coming to the discussion of the waterways, on which Dr. Cuthbert Christy touched fairly fully, I must confess that he does not give me any greater hope than I have had as to their ultimately successful development. It is the extremely low slope of the northern portion of that area which is the fundamental difficulty. and it seems to me, though you may remove blocks and keep open by artificial means the main channels, the main unfavourable factor is the extremely low slope of that large waterway running from east to west, the lower reaches of

the Bahr el-Ghazal, Lake No, and the beginning of the White Nile which continues down the course of the White Nile itself, for between Kodok and Khartoum is a reach of hundreds of miles where the slope is little more than half an inch to the mile. In the area which Dr. Christy has described the streams flowing down from the watershed with a good fall have, from his account, considerable possibilities; but in flood-time they carry a heavy load of silt, and are naturally checked on reaching this region of very low slope; thus the river-beds are raised and the water begins to spill right and left. I confess from what I have heard this evening I do not see any very clear direction in which much amelioration of that northern part of the area is to come. Is this region to be developed later by the alternative route that Dr. Christy has indicated, whether by road or railroad, coming in on the north-west? As you may have noticed, the line Dr. Christy indicated through Wau, Rumbek, and on to Ghaba Shambe, is that at which the slope of the country becomes very low; where the rivers coming down begin to deposit silt, and where the flooding must of necessity take place in the rainy season. That, of course, still leaves all that higher country behind it, which we have heard to-night is a country of great promise, and I hope that the development of that area will be as fortunate as the lecturer has foretold.

The PRESIDENT: The question of tropical diseases in this part of the world is a very important one, and I will therefore call upon Dr. Andrew Balfour, who was the Director of the Wellcome Tropical Research Laboratories there.

Dr. ANDREW BALFOUR: I fear I cannot add very much to the interesting and erudite lecture that my friend, Dr. Cuthbert Christy, has given us this evening. I do not know the Bahr el-Ghazal very well, but his lecture and his pictures recalled to me very vividly a journey I once made from Lake No to Wau partly by river, partly by land, when engaged upon sleeping sickness work. We began of course with the Bahr el-Ghazal, which looks wonderfully like a canal, because the current is so sluggish and the surface so placid. But I am quite sure no bargee ever looked out upon what we did in making that journey, and I am convinced if you suddenly transported a bargee to that spot and he gazed upon what we saw he would think he had *delirium tremens*. For example, I remember how the steamer suddenly flushed from the sudd at the river-side a huge hippopotamus, looking very pink in the sunlight, which lumbered along and then itself put up a sitatunga, one of those long-haired, water-loving antelope which are rarely seen, but an important animal from the medical point of view, not perhaps in the Sudan, but certainly on the Sese Islands of the Victoria Nyanza, because there it is the principal animal reservoir of the parasite of human sleeping sickness. We do not know if it harbours the trypanosome in the Sudan, and it does not greatly matter because the sitatunga is rare in that country. On the other bank you see beautiful antelope, mostly white-eared cob, often standing upon the anthills of which Dr. Christy spoke. There are scattered villages of the Nuers on this bank.

Now you have heard to-night of a disgusting habit of the Dinkas. I am sorry to say the Nuers have also a disgusting habit. They bleach their hair a foxy red with a very unsavoury mixture, and also smear themselves all over with wood ash as a protection against mosquitoes, so that you may imagine the curious and startling appearance they present. Furthermore, they have not only disgusting but dangerous habits, for they are accustomed to add to cows' milk the urine of domestic animals, and one has to be very careful in purchasing milk in that region. The danger arises because undulant fever, as Malta fever is now called, exists in the Sudan, and its causative organism is found

in the milk and urine of infected goats. I know of one case in which a distinguished British officer was in all probability infected from drinking milk contaminated in that way.

Proceeding up the river you pass through lake Ambadi, as it is called now, though for a time it was known as lake Fell, being named after one of those gallant officers whom Sir Edgar Bonham-Carter mentioned, and who lost his life in the exploration of these sudded solitudes. It was there that Schweinfurth saw long ago little bright yellow tortoises browsing at the bottom of the lake. I did not see any of them, but it was wonderful to watch the fish swimming about amongst the coiling stems of the Vallisneria. Further up is Meshra, near the island known as "God help us Island"—very well named, too. Meshra is an appalling place, and very unhealthy with malaria and blackwater fever prevalent. Mademoiselle Tinné, the brave Dutchwoman who went there long ago, suffered heavily. Her expedition was prevented by sickness from continuing its work. Out of seven Europeans five perished from these dread diseases. We know better now how to combat them, but Meshra is certainly still a dangerous place. I cannot help feeling, in spite of what Dr. Christy says, that it would be a very difficult matter, on account of malaria, to place this part of the Province under cultivation. The northern Sudan is bad enough in this respect when you begin to irrigate. The south would be infinitely worse. It is interesting to remember that, according to Seneca, two centurions of the Roman army actually got as far as Meshra, so that there were good men in those days as well as at present.

The journey across country to Wau is exceedingly interesting. There are all kinds of entertaining sights in the way of wild animals. One of Dr. Christy's pictures of the lechwe supporting their wounded comrade made me think of something I saw on that safari. But not in the way of antelope. A hyena suddenly appeared from the side of the road, and although it must have seen me and known that I had a rifle in my hand, for I fired at it, it did not attempt to fly. Whether it knew I was a bad shot, I cannot say. I could not understand its indifference, because hyenas are not very tame as a rule. And then I discovered it had been waiting for a wounded comrade or mate which had been caught in a trap and had its fore leg broken. That animal was waiting upon the other although probably it knew it was in some danger. I confess I took my hat off to the hyena upon that occasion.

I have already mentioned a few diseases. One from which the Dinkas frequently suffer is yaws, a horrible skin disease in which the persons affected get covered with yellow crusts. It is not often fatal, but when severe it causes great misery. In another part of the Bahr el-Ghazal, namely at Shambe on the main Nile, I once saw a Dinka village where all the people, men, women, and children, were the victims of bad yaws. They presented a pitiable spectacle. It is most necessary that medical relief should be brought to these people, because that disease, thanks to recent work, is now very readily curable. It clears up quicker than almost any other tropical complaint by appropriate treatment with the organic arsenicals. On the main Nile there is now a small steamer that goes up and down the rivers as a kind of floating hospital, and nothing is more calculated to help the native, or make the Dinka tame, than extending help to him in this way. You win his confidence by that means as in no other manner.

We would like to know more about the diseases from which the Dinkas and other Nilotic tribes suffer. In order to examine Dinkas, or indeed anybody else when studying tropical disease, it is usually necessary to make a skin

puncture and draw blood with a needle. But if you do that with a Dinka the chances are he will try to draw your blood with a much more serious instrument. So that there is need of care. From sleeping sickness there is considerable danger, both from the French Congo and from the Belgian, though perhaps more from the latter nowadays. At present efforts are being made to collaborate with both the French and Belgians, our very good friends, in an attempt to exchange information which may be helpful in preventing sleeping sickness cases wandering about and infecting people in regions where the tsetse fly abounds.

The only other point I wish to mention is that our journey ended in rather a tragic manner. When we approached Wau, climbed the great ironstone ridge and looked down upon the river Such across to the little capital with its red roofs showing amongst the green foliage, and altogether a very pretty place, we noticed flags flying at half-mast. We wondered what was wrong. The Governor-General of those days, Sir Reginald Wingate, we knew was very ill in this country, and we feared the worst regarding him. We were met by the Governor of the Province, and we asked him, "Why are the flags half-masted? What is wrong?" And he replied gravely, "I am sorry to say that the King is dead. He died two days ago." It was 9 May 1910 King Edward had died, and in this remote spot the episode brought home to one the immensity of the British Empire. It was a curious if somewhat dramatic end to a very interesting journey.

The PRESIDENT: We have one more gentleman who could add a few words to this discussion, Colonel Poole, who was in the Bahr el-Ghazal with the Egyptian Army and discovered the Congolese Expedition under Colonel Le Maire in that province.

Colonel POOLE: What I have to add to the information with regard to the Bahr el-Ghazal is rather of an old date, for my connection with it began as long ago as 1901, when I was serving with the Allied Forces in North China. General Marchand was then a staff officer with the French Forces, and he and I and General Macdonald were entertained at dinner by a Japanese general. When we were talking about Africa General Marchand described the Bahr el-Ghazal to me. He described the shoe-billed stork, the swamps, and so on. There was another French officer there who had been across Africa with him, and we all agreed that a more God-forsaken part of Africa it would be hard to find. For my sins, eighteen months later I was in the Bahr el-Ghazal. In 1903—about this time twenty years ago—I was sent from Wau to Rumbek to open up communication for the annual supplies. On my reaching Rumbek news came that a cannibal tribe called the Niam-Niams had eaten up some of our people and protection was required. So I sent a small post, consisting of six men, to the cannibal country to drive off the cannibals if they attacked again. Shortly after that a message came that Europeans had been seen in a certain neighbourhood. I went down to the certain neighbourhood—it was very vague—but a small post had been attacked there, and I had to leave more men and return to Rumbek. When I arrived at Rumbek the sergeant from the cannibal post came and said there were five Europeans with about 100 soldiers and 150 carriers at a place called Mvolo in the Bahr el-Ghazal. By this time one's force was rather scattered, and I managed to raise six men and went to try and find out who these people were. Eventually I found a certain Commandant Le Maire with four other Belgian officers and about 100 Congolese soldiers and 200 carriers installed at Mvolo rapids. He was a distinguished African traveller, and I had heard of his journey from the Congo

when I was in British Central Africa some years previously. He stated that his mission was a scientific one and showed me his recent investigations. There had been great solicitude on the part of Colonel Marchand to reach the Bahr el-Ghazal, and this seemed to be to my mind possibly a similar expedition, but I was assured that it was a scientific expedition, and could not say it was not. After asking Commandant Le Maire to withdraw I retired to Rumbek. With six men, to sit opposite some one having 100 men and to keep on telling him to go was hardly dignified. After that the Governor of the Bahr el-Ghazal arrived with a larger force, and eventually Commandant Le Maire was induced to withdraw. Subsequently the boundary was delimited, and with the handing over of the Lado Enclave to the Anglo-British Sudan on King Leopold's death, this question has naturally been dropped. I trust I may be pardoned for referring to this at a geographical lecture, but there was no doubt that about 1896 and 1904 the Bahr el-Ghazal was a very important place in connection with the control of the Nile waterway.

In regard to other points that have been raised, notably that with regard to the Dinkas: The present Governor of the Bahr el-Ghazal, I am glad to say, bears out one's idea as to the intractability of the Dinkas. Comparing them with another cattle-owning tribe of Africa, the Angoni Zulus in Northern Rhodesia, they are more intractable and inaccessible, but there is, I think, a certain seriousness and independence about the Dinka that is rather attractive. He makes a very good soldier, and many of the best riflemen of the Khalifa's army were Dinkas, and they are good soldiers in the Egyptian army of to-day.

The cultivation that they carry on is slight. Twenty years ago they used to rely on looting a great deal of grain from their neighbours, who I think were the Golos and Jurs. As for work, it was very hard to get them to work, even for pay. I remember on one occasion I had promised them pay if they made a certain piece of road. When I went there the road had not been made. I was annoyed and seized the headman. Nothing happened; nobody came near me, even though I had seized the headman. Eventually I had to send for the sons of the headman and say that unless they went on with the work I would keep the headman still in prison. "Oh," they said, "that old man; you can put a bullet in him if you like"! So that we see the difficulties with regard to the Dinkas.

The PRESIDENT: I have not myself been to the Bahr el-Ghazal, and after hearing the various accounts which have been given to us this evening I am not sure that I particularly want to go. It seems to me that even the methods by which one is welcomed by the inhabitants have their drawbacks. And from what has been said by other speakers there are drawbacks of no small moment connected with the country and its people. All the more grateful, therefore, am I to Major Christy for having gone there and then come back to tell me all about it, and I should imagine that my attitude is that of ninety-nine out of a hundred of those who are present this evening. You will, no doubt, wish therefore that I should express to him, on your behalf, your deep gratitude to him for having given us an account of the country this evening.

AIR SURVEY AND ARCHÆOLOGY

O. G. S. Crawford

Read at the Meeting of the Society, 12 March 1923. Map follows page 392.

THOSE who have walked over the chalk downs of Southern England cannot fail to have observed certain low grass banks and narrow shelves of soil which are to be found there. A closer inspection shows them to be arranged in a chess-board pattern of squares and rectangles and other figures. They are most common on sloping ground and reach the greatest dimensions on the sides of steep valleys. They differ from other banks in that they are not usually accompanied by a ditch. Whence then came the soil of which they are formed? It has accumulated through the action of gravity and rain-wash on the lower edge of cultivated land; the immediate cause is Nature, but the ultimate cause man.

These shelves and banks have many local names; that which is, I think, most generally adopted is "lynchets." There are two kinds which are not contemporary and which belong to two radically distinct systems of agriculture. The first kind is that which has just been described, arranged in chess-board fashion. This kind I shall, in anticipation, call the Celtic type. It is with the Celtic type that we shall be principally concerned to-night. The later Saxon type which succeeded will be briefly described later.

It is the great merit of air-photographs that they reveal earthworks upon ploughed land which are invisible to the observer on the ground, or which appear to him only as a confused tangle. This was forcibly brought home to me when I walked over the fields near Windmill Hill, Hampshire. From the air an orderly system is visible. The bands of lighter-coloured soil are the field boundaries of a vanished agricultural community; they consist of broad low banks; and their lighter colour is caused by the admixture of small grains of chalk. It was possible to detect this fact on the ground, but quite impossible to see there any system at all, and it would have been almost impossible to construct an accurate plan. With the help of air-photographs, however, this can be done. It has, in fact, been done. The plan reproduced (Map) has been made by plotting these lynchets from air-photographs on to the 6-inch map. The smaller squares represent the individual fields; the hatched lines represent the boundaries of groups of fields, and are connected no doubt with the system of tenure. Further study may enable us to determine whether these groups seem to follow any rule of size or whether the number of plots in them is at all constant. The present map is intended to show possibilities rather than to establish conclusions.

Lest you should think these lynchets a mere byeway of archæology of no great significance, let me explain what they reveal. The diagrams

I have made are nothing less than accurate plans of the fields of a group of communities which ceased to exist about 1500 years ago. Remains of the villages where lived the people who cultivated these fields can still be seen upon the downlands of Wessex and Sussex. Two of them—Rotherley and Woodcuts in Cranborne Chase—were completely excavated by General Pitt-Rivers; one near Winchester was excavated in 1921 by Mr. Hooley. Quite recently others in Wiltshire have been or are being excavated by Mr. and Mrs. Cunnington, Dr. Clay, and Mr. R. S. Newall. These excavations have yielded pottery, brooches, coins, and implements which enable us to assign all such villages to a definite period of time—B.C. 450 to A.D. 450. As might be expected, in the majority the objects found belong to the period of the Roman occupation, but in a few instances pre-Roman remains only have been found. For my present purpose, however, it is sufficient to note that all these upland villages fall within a period of 900 years, and that many of them were continuously occupied from a century or two before the Roman conquest up to the end of the Roman occupation. There is no conclusive evidence that any single one of them was occupied at an earlier date than the beginning of the Iron Age or later than the Roman period.

From the village, and often through the middle of it, led a road or lane of a peculiar and highly interesting type. In external appearance to-day it consists of a slight depression, about the necessary width for a cart, bounded on each side by a low bank. Excavation has proved that it was also bounded by a ditch on each side. These tracks may often be followed for a mile or two over the downs; and it is important to note that they thread their way between the fields in such a way as to prove, beyond the possibility of doubt, that they were contemporary with them. One of the best instances of such a road is that which led from Windmill Hill, near Avebury in Wilts, to Totterdown. This road can be traced continuously over the open grass downs for a distance of two miles. It is best seen at the eastern end, where it climbs a gentle slope between ancient fields whose lynchets (set with rows of sarsens) cover the whole down. No one who walks along this road and observes the lynchets which abut it on either hand can have the slightest doubt about the real character and contemporaneity of both. A similar road passed through the Romano-British village of Woodcuts, excavated by General Pitt-Rivers; a section dug across these was published by him. Very often these roads led to a pond. That is so at Totterdown, where there are several (now dry) one above the other, strung along the bottom of a dry valley. A hollow way led also from the site of a village near Abbot's Worthy in Hampshire to a huge and very deep pond at the bottom of the valley to the north.

These roads are part and parcel of the cultivation system which obtained during the occupation of these upland villages. That they were not in existence before the fields were formed may be proved from

the fact that occasionally the roads make short right-angle turns. This was to pass round a field which lay in the track. The twists and turns of many of our modern roads may be similarly explained. It is because these roads cannot be separated from the cultivation system that they are of such importance. For with their help it is possible to prove that the whole system was in existence before the Roman conquest, and that it lasted with little or no modification throughout the Roman occupation.

My main purpose to-night is to prove the age and duration of the agricultural system which produced the Celtic type of lynchets. It will be necessary, therefore, to give definite instances in support of my views. Such evidence is either direct, derived from the relation between lynchets and other earthworks whose age is known, or indirect, derived from the study on similar lines of the roads already referred to. Direct evidence of the age of lynchets is peculiarly difficult to obtain; they have a way of disappearing at the crucial point just where they meet some other earthwork. There are however a few instances, and I have no doubt whatever that when a larger series of air-photographs is available for reference, these instances will become more numerous. One such has been described by Mr. Toms, one of the few British archæologists who has tackled the problem in recent years. Writing about Cissbury Camp in the *Sussex County Herald* (24 June 1922) he says, "That some of the cultivations [*i.e.* lynchets] within Cissbury are distinctly earlier than the fort is proved by the inner ditch, which wholly intersects and partly cuts through another very reduced lynchet at points 11 and 12 on the plan accompanying this article."

Recently I had the pleasure of visiting Cissbury in company with Mr. Toms, who pointed out to me the site where this interesting conjunction occurs. The lynchets in question are quite unmistakable; there are many within the area of the camp, and the two cited by Mr. Toms run down the slope to the rampart on the north-west side. They meet the inner ditch at right angles. Now, if they had been formed subsequently to the digging of this ditch, a horizontal lynchet must have been formed also at right angles, connecting them up along the third side of the field, and in a direction parallel with the inner ditch and rampart. There are no traces of any such lynchet, and it is therefore quite certain that the lynchets are older than Cissbury Camp. It is, however, unlikely that the interior of the camp would have been cultivated; and it is probable, as suggested by Mr. Hadrian Allcroft, that they form a single system with those outside on the slopes of Vineyard Hill to the south.

In passing it may be observed that the cultivation patches here are clearly later than the shafts of the flint-mines. They seem to have been fitted in between the areas covered by these shafts, as would be expected; and in some cases the depressions marking the sites of shafts appear to have been included within the cultivation area. In no single instance does a shaft break into a lynchet, as it surely would have if the lynchets

had been there when they were made. But the age of these shafts is so great that few if any archæologists would suggest that they were contemporary with the lynchets.

The age of Cissbury Camp has not been determined beyond dispute, and Mr. Toms has recently suggested that it was made during the Roman occupation. It is not possible now to discuss this matter; it is enough that even supposing Mr. Toms' suggestion to be correct (which I doubt), the lynchets must have been already in existence in Roman times.

By far the clearest evidence is found at Soldier's Ring near Martin (now in Hants). Here the lynchets are all quite certainly older than the earthwork which cuts through them in many places. This can best be seen from the plan and air-photograph. The interior of the earthwork contains many lynchets. It has never been excavated; but I agree with Mr. Heywood Sumner in thinking that it is Roman. It seems to be of a pastoral character, like that which Mr. Sumner excavated on Rockbourne Down not far off and which he proved to be "a farm settlement of the Romano-British period—in plan Roman, not British."* Soldier's Ring is badly named, for, as Mr. Sumner has observed, it is neither circular nor of a military character. It lies in a hollow of the downs, and is in a beautiful state of preservation. The bottom of a broad shallow valley runs through the northern part, and on the slopes on each side are lynchets which come down to the valley from the hills above. The lower portions of these lynchet-fields are enclosed within the ramparts of Soldier's Ring, which cuts through the lynchets in several places. So good is the condition of the ramparts that it is possible to detect a slight bump in bank and berm where a lynchet is crossed. The whole earthwork is the shape of a pointed (heraldic) shield; the western side is straight and cuts through a lynchet at a very obtuse angle—the two run almost in the same direction. The northern side is curved, and was, I think, made so of set purpose in order to follow a lynchet which runs alongside and just within the enclosure. The lynchets on this northern side are part of a system which covers a spur between Soldier's Ring and the Allen valley. On the top of this spur are the remains of an upland village, doubtless the home of the people who tilled these fields. The ground has been ploughed in recent times, but it is hummocky and there are many burnt flints, potsherds, and some iron slag lying about. On Tidpit Common Down, half a mile further west, is another such village.

But, indeed, I need not labour to prove the pre-Roman age of the Celtic lynchet system. It is agreed amongst all who have studied it at first hand. It is less easy to prove how long before the Romans came this Celtic system was in operation. I believe myself that it was introduced at the beginning of the La Tène period.

* 'Excavations on Rockbourne Down, Hampshire,' by Heywood Sumner, F.S.A. Chiswick Press, 1914. Price 2*s*.

In addition to roads there is another kind of earthwork closely resembling roads and often very difficult to distinguish from them. I refer to those boundary ditches which are so common in Wiltshire and Dorset and Western Hants, and of which some fine examples occur on Salisbury Plain. They consist of a ditch with a bank on one side, or sometimes a bank on both sides. They can often be traced continuously for several miles, and are generally found to enclose an area. A very instructive example may be seen on the north of Quarley Hill, Hampshire. Here an area of many acres is enclosed. At each end is a smaller enclosure, within which Mr. Percy Farrer records the presence of pot-sherds scattered over the surface. It is evident that these enclosures were the site of habitations. These boundary-ditches meet at the top of the high hill on which Quarley Camp stands; and it will be observed that in at least two places they are cut through by the ramparts of the camp. They are therefore certainly older than the camp; and if the orthodox view that these hilltop camps are pre-Roman is correct, it must follow that the boundary-ditches here are considerably earlier than the Roman conquest.

The relation between the camp and the ditches could hardly have been brought out more plainly than by the air-photograph; but, lest there should be any doubt, I should add that both Dr. Williams-Freeman and I observed it on the spot independently, and it was for this reason that Quarley was selected for an air-photograph. The ditch comes up to the camp on the north-east and ends abruptly at the ditch of the camp at a point where there is not any entrance to it, and it is continued inside the camp. Incidentally it should be observed that the angular turn made by the ditch on the top of the hill near the middle of the camp is slightly less than a right angle. I think it was intended for a right angle; but, as every surveyor knows, when one attempts to set out a right angle without instruments one nearly always underestimates the angular width.

Having proved some of these boundary-ditches to be older than a hilltop camp, it would be superfluous to describe instances where they, and the roads which so closely resemble them, can be proved to be older than the Romano-British or later antiquities.

Let me briefly summarize the conclusions reached at this stage. A network has been revealed consisting of lynchets, boundary-banks and roads, and associated with upland villages. Some of these were certainly in existence before the Roman conquest. The network, which I call Celtic, is homogeneous, and the relationship between the parts of which it is composed is such that they form an organic system. Some elements of this system have been proved to be older than Roman remains and hilltop camps, but later than the shafts of neolithic flint-mines. The system continued in operation throughout the Roman occupation. Can we discover when it began? I think it is possible to ascertain this date approximately, by similar methods.

Sidbury Camp, near Tidworth, Wilts, is a centre from which radiate a number of boundary ditches and banks. Those which run northwards from it are of a peculiarly elaborate kind, but there is no reason to dissociate them with respect to their age from the rest. At a point about 600 yards from the north rampart of the camp they cut through a large disc-barrow, and they must therefore be later than the disc-barrow. This fact was observed and recorded by Sir Richard Colt Hoare in 1819 ('Ancient Wilts,' vol. i. p. 181 and plan opposite p. 180). There is another disc-barrow near Crawley Clump, 4½ miles north-west of Winchester. It is one of a group of three barrows, one other of which appears also to have been a disc-barrow—ploughing has obliterated all traces of a central tump—while the other is an ordinary mound. The group lies within a lynchet area, and the lynchets are deliberately arranged so as to avoid the barrows. This can be seen from the air-photo, but is more evident on the ground.

Having, so to speak, sandwiched the beginnings of the Celtic cultivation system between disc-barrows and hilltop camps, it remains to ascertain the date of these types of earthwork. Lord Abercromby says ('Bronze Age Pottery,' 2, 84): "The earliest of these disc-shaped barrows . . . may be assigned to Bronze Age II., but the style may have lasted into the third or fourth period." I am in full accord with this dating. The evidence of finds shows that burials in disc-barrows are almost invariably cremated; bronze knife-daggers and pins have been found but no copper knives, and only in one doubtful instance a beaker (now lost). On the other hand, no pottery of the later finger-tip type has ever been found in a disc-barrow. Lord Abercromby dates his fourth period of the Bronze Age from about B.C. 900 to 650. If he is correct, the latest disc-barrow cannot be later than about 650 B.C. The lynchets at Crawley, therefore, and the banks near Sidbury, which are both later than disc-barrows, may be later than 650 B.C., but cannot be earlier than the full Bronze Age. I think, for reasons which will be given shortly, that the date 650 B.C. is probably within a century or two of the date when the Celtic cultivation-system was inaugurated. But I hesitate to place much reliance on the absolute chronology of any British archæologist.

The date of the defensive hilltop camps * is less difficult to determine. Of those which have been excavated, not a single one has been proved

* I use these words "without prejudice"; I believe that many hilltop earthworks, and some others, will prove, when excavated, to be sacred enclosures of neolithic age, like that on Windmill Hill near Avebury. Again, while attributing the majority of defensive hilltop camps to the Iron Age, I agree with those who think, as Dr. Williams-Freeman for instance does, that many of the hills on which they were constructed may have previously been occupied during the Neolithic and Bronze Ages. There are good reasons for supposing that the hill of Danebury in Hampshire was so occupied. In this instance, all superficial evidence of such occupation would have been obliterated by the tremendous and elaborate defences of the Iron Age fortress which now crowns it.

to have been made before the first part of the La Tène period—before, let us say, 450 B.C. This is the usually accepted date for the beginning of the Early Iron Age in this country. It is not necessary that Quarley Hill camp should date from 450 B.C.; but if it did it would mean that the boundary-ditches, which are older than it, need not necessarily have been made before 450 B.C. The age of some camps can also be determined by their treatment of round barrows. From air-photographs it is clear that the camps of Scratchbury and Battlesbury in Wilts are later than certain round barrows upon which their ramparts impinge.*

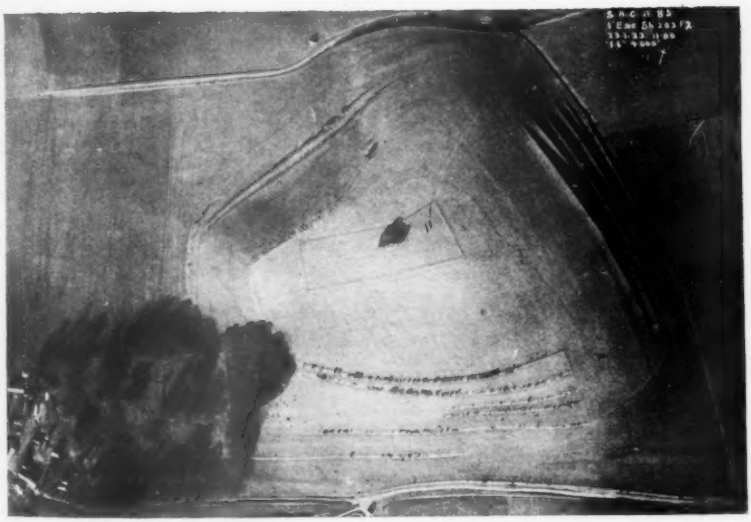
It remains to consider the relation between lynchets and certain earthworks whose date has been determined by excavation. Cranborne Chase, on the Wilts and Dorset border, abounds in lynchets, and thanks to General Pitt-Rivers' excavations the date of many earthworks is known. Three of these—South Lodge Camp, the Angle Ditch, and Martin Down Camp—belong to the same period, the late Bronze Age. They seem to be little if at all earlier than the Iron Age village of All Cannings Cross; but they yielded no iron objects, and none of the "superior" red burnished ware which Mr. and Mrs. Cunnington have found at All Cannings Cross. I have examined the relation between all three earthworks and the lynchets round them, and while the results are rather inconclusive, I feel sure that the lynchets cannot be *older* than the earthworks. (I have to thank Mr. Toms for the loan of his notes and plans and for much valuable assistance.)

Cranborne Chase is a region which will still reward the student of minor earthworks, even after the General and Mr. Heywood Sumner have been there. The ditches which are revealed on the ploughlands and downs by air-photos may be followed on foot in the woods by the field archæologist. It is a region where one might well hope to get really definite results from air-photographs; and indeed the whole of Dorset is a most promising region.

The working hypothesis which I am adopting is that the Celtic system must have been introduced later than the full Bronze Age but several centuries before the Roman conquest. (The evidence of lynchets proves that this system was largely an agricultural system; the boundary-ditches suggest pastoral needs, and are the natural complement of extensive areas of cultivation; and in any case their relation to the lynchets proves both to be parts of the same system.) The word "introduced" implies that the system was brought into this country from outside, and that it did not evolve here. Is there any other evidence of the arrival in this country of a new race with new social customs at about

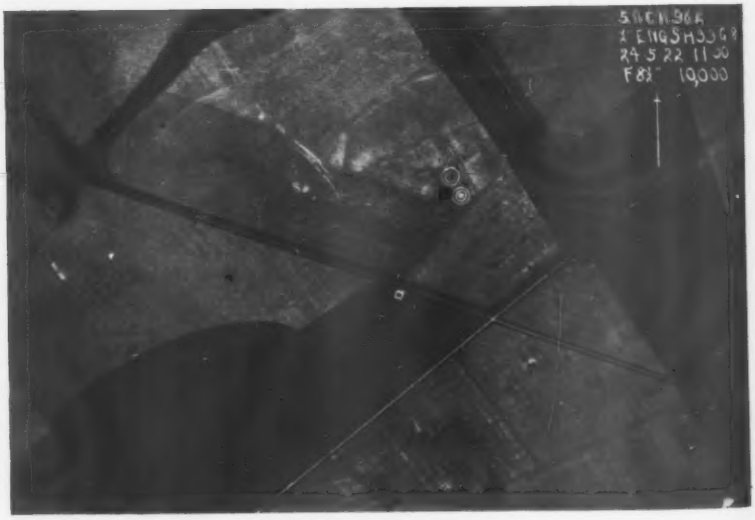
* Within the area of Scratchbury are traces of a round enclosure which I suspect to belong to the earlier group already referred to. If it was originally a complete circle it is clearly older than the straight bank which cuts across it. This bank, which has been partially obliterated by modern ploughing, seems to be part of the original defences of the camp; and may be paralleled by a similar cross-bank in Oldbury Camp near Avebury.

CELTIC LYNCHETS, WINDMILL HILL, HANTS



SAXON LYNCHETS, MIDDLE HILL, WILTS

NORTH OF CRAWLEY CLUMP, HANTS



CRAWLEY CLUMP, HANTS

the middle of the first millennium before Christ? There is abundant evidence. It would take too long to describe it here, and I have already done so in the *Antiquaries' Journal* for January 1922. I suggested there that certain types of pottery and bronze implements and certain rectangular earthworks contemporary with those types were introduced by the first wave of Celtic-speaking peoples. The date proposed (about 800–700 B.C.) was perhaps too early by a century or two.* But the true date in both cases must fall in the middle or the second half of the first millennium, and it has been arrived at in each instance by a study of different evidence. We may therefore conclude that one and the same set of invaders, broadly speaking, were responsible for all these innovations—for finger-tip pottery, for new types of bronze implements, for the first introduction of iron, for square camps, and for the Celtic system of lynchets, boundary-ditches, and roads.

That agriculture was known during the Bronze Age seems to be proved by the discovery of part of an ear of wheat carbonized in a food-vessel (J. R. Mortimer, ' Forty Years' Researches,' pp. 111–112). The vessel belongs to Abercromby's Type I*a*., and it is difficult to see how it can be much later than the second period of the Bronze Age. It would however be rash to rely too much upon such a slender thread of evidence. (We do not know how long this type of food-vessel may have continued to be made in Yorkshire.) There are many possible systems of agriculture, and I am merely maintaining that the one I have called " Celtic " was new, not that it was necessarily the first to be adopted here. I am anxious rather to prove that the system is prehistoric, and not later, since critics are more likely to deny its antiquity than to assert that it is older than I have made it out to be. Those, if any there are, who believe the neolithic inhabitants of England to have practised agriculture, are welcome to believe that the system I have called " Celtic " originated in neolithic days. If so, let them either prove it or produce convincing evidence of the neolithic system of agriculture.

That the pre-Roman people of Britain practised agriculture on a large scale admits of no question. The evidence, both historical and archæological, is abundant and convincing. Pytheas,† who discovered Britain in the fourth century B.C., during the La Tène I. period, reported that " the natives collect the sheaves in great barns and thresh out the

* It was based on the association of typical late Bronze Age objects, such as razors, with finger-tip pottery in the ditch of South Lodge Camp, Dorset. But the discovery of a broken socketed celt and leaf-shaped razor, both of bronze, at All Cannings Cross by Mr. and Mrs. Cunnington proves that these typical Late Bronze Age objects and the associated finger-tip pottery, were in use as late as the beginning of the Iron Age. There was probably more than one wave of invaders; but the absence of the fine burnished hæmatite pottery at South Lodge Camp may perhaps be deemed insufficient to prove this.

† An excellent account of the voyage of Pytheas by Sir Clements Markham will be found in the *Geographical Journal*, vol. i. June, 1893, pp. 504–524.

corn there, because they have so little sunshine that our open threshing-places would be of little use in that land of clouds and rain" (Strabo, IV. v. 5, quoted by C. Elton, 'Origins of English History,' 1890, p. 30). The custom survived until quite recently, and I have seen it in operation. Except that the threshing is now done by a machine, the existing practice is identical. Diodorus Siculus, who wrote in the latter part of the first century A.D., says that the Britons "cut off the heads of the corn and stored them in underground dwellings" (καταγείους οἰκήσεις, Diod. Sic., v. chapter 21, quoted by Elton, p. 467). Such storage pits (some still containing wheat) have been found in nearly every Romano-British or earlier village and hilltop camp that has been excavated, including the famous early Iron Age village of All Cannings Cross (La Tène I.). It is plain from Cæsar's account that corn was grown over a large part of Britain; indeed, from his reference to the Belgæ we may imagine, if we like, that he was describing some of the actual fields whose plan has been shown to-night. He says that, after the invasion, they (the Belgæ) remained and cultivated the fields ('De Bello Gallico,' v. 12). Winchester (Venta Belgarum) was later the capital of the Belgæ, and the adjacent village on Worthy Down must have been occupied when he wrote. He contrasted the inhabitants of the coastal regions with those of the interior "who did not sow corn but lived on milk and flesh, and clothed themselves in skins."

Collateral evidence of agriculture in Britain is given by Pliny, who wrote about A.D. 70. He describes the use of chalk for fertilizing the fields as follows: "Alterum genus albæ cretæ argentaria est. Petitur ex alto, in centenos pedes actis plerumque puteis, ore angustatis, intus, ut in metallis, spatiante vena. Hæc maxime Britannia utitur. Durant annis octaginta" (xvii. 4). "The chalk is dug from shafts, often a hundred feet deep, with narrow tops but spreading out below. The effects last 80 years. This practice is very common in Britain" (see Johnson, 'Folk Memory,' chapter xi.). Now I would ask you to look at the photograph upon the screen of some fields north of Crawley Clumps, near Winchester. You will notice a number of round white spots, often occurring at the ends of lynchets, or at points where the lynchets turn or intersect each other—that is to say, on the edges and in the corners of the Celtic fields. These are shallow pits, and I make the suggestion that they are actually shafts of the kind described by Pliny. This custom of marling was in vogue throughout the Middle Ages. Mr. Nicholson, who knows Hampshire and its customs very well indeed, has told me that he has heard the ancient procedure described to him by Hampshire peasants. The practice of marling is not yet quite extinct. Only last year a field which I pass every day was dressed with chalk, fetched from a distance of several miles. It would be easy to digress further, and to discuss the relationship of marl-pits (ancient and modern) to flint-mines and storage pits; but for my present purpose it is enough

to state that Pliny's statement is borne out by archæological and historical evidence, and that it is additional proof of a highly developed system of agriculture in Britain in the first century of this era.

The Celtic system began here, I believe, within a century or two of 500 B.C. It lasted in England for about a thousand years, and it was brought to an end by the Saxon invasions. But in Wales and the rest of the Celtic fringe it may have survived in a modified form to a later date. An interesting glimpse of social conditions in Britain before the Roman conquest is given by the Laws of Ancient Wales, which may reflect a pagan order and therefore go back to the third century at least.

The Celtic system lasted in England for about a thousand years. There was an essential unity throughout which marks it as an epoch in the history of our culture. There were, during this epoch, no violent changes of race, language, or traditions; and the agricultural system seems to have remained quite unchanged. Two invasions took place: the first, of kinsmen who soon became amalgamated; the second, of alien conquerors who left the natives to their own devices. But neither the Belgic nor the Roman invasion interrupted the evolution of our native culture, though they may for a time have modified it somewhat. We know little or nothing as yet of the effects of the Belgic invasion—which, moreover, only affected part of southern Britain—except that it was followed, or accompanied, by a remarkable outburst of really fine art. (The Roman conquest killed this art; but it survived within the Celtic fringe, where it blossomed out again seven hundred years later.) Of the effects of the Roman conquest upon society we know a little more. Life in the upland Celtic villages continued much as hitherto. Luxuries even began to be introduced—perhaps the fashion was set by the rich people of the villas. Oysters were eaten, and some of the cottages and farms were warmed by hypocausts. The villages were well drained, but even the Roman influence could not break the Britons of the unpleasant habit of burying their relations in their huts and courtyards.* In England a system of excellent roads and policing enabled the rulers to prevent tribal warfare. In Wales, as Dr. Wheeler has recently demonstrated, a native militia was allowed to defend itself by its own traditional methods against the common foe across the Irish Sea.

Perhaps it was the enervating effects of four hundred years of peace, perhaps it was the fault of our geographical position, but from whatever cause, the Celtic culture of England came to a sudden and violent end. For some time before the Roman legions departed occasional bands of pirates had been raiding the east and south coast; forts and

* Instances are given by Dr. R. E. M. Wheeler, 'Roman and Native in Wales, an Imperial Frontier Problem,' p. 76, note 1. *Trans. Cymmrodorion Society*, 1920-21; published 1922. Dr. Wheeler's monograph of 96 pages is fully illustrated by plans, with a map of Roman Wales, and is the best and most up-to-date general account of the subject.

signal stations had been built. This scheme of defence was administered by a military commander called the Count of the Saxon shore. It was in working order at least as late as the year 428; and it is probable that civilized life continued until about the year 442 (see Prof. Bury's article on the Notitia Dignitatum, *Journal of Roman Studies*, vol. x. 1920, pp. 131–154). Then came the crash. The Saxon barbarians poured in and completely wrecked the Celtic civilization. Only in the west did it survive; there, geography and the native levies would have sufficed to stem the tide. But the Saxons had secured the fertile plains of England and it is in any case unlikely that they would have troubled to attack the mountain forts of Wales.

It is with agricultural systems that I am mainly concerned to-night; and I hope to show you that an entirely new agricultural system was introduced by the Saxons. But before doing so I must say a few words about this hiatus between the Celtic and Saxon epochs, in so far as it is revealed by other kinds of evidence. The hiatus itself is so evident that this might seem unnecessary; but it has been bridged by writers who wish to prove a Roman origin for our institutions. But what single institution can we trace back to a Romano-British source? What vestige of the Roman civilization of England survived after the hiatus? Archæology (see, for instance, Haverfield, 'Ancient Town Planning,' Oxford, 1913, pp. 142, 143) agrees with Gildas in asserting the overthrow of city life. Writing when the storm was at its height, he said: "Not even at this day are our cities inhabited again, but they lie deserted and overthrown." Even the upland villages were utterly destroyed; not a vestige of a Saxon object has ever been found in any one of them. Conversely, no evidence is forthcoming that the Saxon villages were inhabited before the Saxons came; nor is there any native or Celtic admixture worth speaking of in the early Saxon cemeteries. Place-names tell the same story; the vast majority in southern Britain (outside Devon and Cornwall) are of purely Saxon origin. Latin loan-words are rare, and few, if any, of them need have been learnt in Britain. Many Roman roads survived, it is true, but some did not, and it is unlikely that any of them were kept in repair. Some at least certainly were not, for the traffic ruts that formed on hills have destroyed the causeway.

The Saxons, as Tacitus says, "hated the life of cities, and dwelt like their forefathers in hamlets scattered along the banks of a stream" (see Elton, 'Origins,' p. 368). They regarded the works of the Romans with respectful dislike, much as a Bolshevist might regard the ruins of the Bank of England, but perhaps with less regret. They admired and used those fine Roman roads which they were unable to construct or even repair, and they attributed Wansdyke to Woden, and, later, to the Devil. They allowed the baths of Aquæ Solis to fall into complete decay, and described their ruin in a sentimental barbaric poem. "Wondrous the wall-stone that Weird hath broken . . . the roof-tree

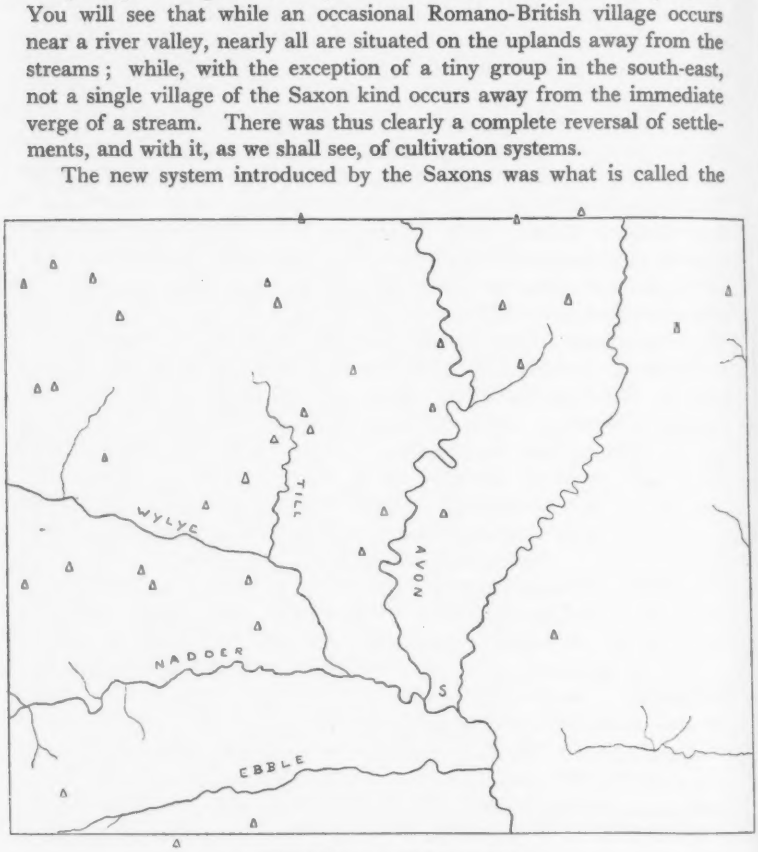
riven, the grey gates despoiled. Often that wall withstood Raeghar and Readfah, chieftain after chieftain rising in storm. . . . And the court is dreary, and the crowned roof lies, low in the shadow of the purple arch. . . . The stone court stands the hot stream hath whelmed it, there where the bath was hot on the breast" ("The Ruin," quoted in Elton, 'Origins,' p. 369).

But it is time to get back to the land system which is the main thread of unity in this rather discursive paper. Seebohm did not believe in the hiatus. He thought that the typical Saxon open-field system (which I shall describe in a few minutes) "had probably long existed under Roman rule in Britain" ('Vill. Comm.,' p. 410). Elsewhere he states the problem very clearly (*ibid.*, p. 425): "What we want to find out is whether, in the *rural* districts, the British villages, with their open fields around them, were generally adopted by the Romans, and whether, having survived the Roman occupation, the Saxons adopted them in their turn." Seebohm was not an archæologist but a student of constitutional history, and his archæological efforts were very unsuccessful. Moreover he selected a very bad region to prove his thesis. The answer is given quite clearly by that palimpsest of British history—Salisbury Plain; and it will be given still more clearly when a larger number of air-photographs of it is available for study. Salisbury Plain is covered with "British Villages." Most of them were probably inhabited before the Roman Conquest; such as were, continued in most cases to be occupied throughout the Roman period; but in not a single instance was any single one inhabited afterwards.* Their sites were abandoned, and may often be seen to-day exactly as they were left, though now, of course, a maze of grass-covered mounds. We do not know what happened during that century and a half of darkness and confusion; but when the dawn broke through once more, we find a totally new system, Teutonic in character, and different in every way from its predecessor. New villages with new Saxon names have sprung up along the valleys; the once populous uplands are deserted; the Celtic fields, now grass-grown, have reverted to thick scrub and forest. The boundaries of the new "manors" disregard the old field system entirely. They are still in existence as parish boundaries. That these are ancient may be proved from the contemporary charters where the boundaries during the seventh to tenth centuries are set down and can be identified by means of the existing field-names and in other ways. The new Saxon manor lay close beside the water-meadow; next came the arable fields; then pasturage, and waste or woodland. There was thus a triple zonal arrangement, of arable, pasturage, and woodland, the zones running parallel with the alluvial water-meadows. To show this rearrangement

* Out of those which have been excavated, of course; and many have been excavated during the past 120 years. No Saxon relic has ever been found in any of them by excavators, or even turned up by moles and rabbits.

of population I have prepared maps of Southern Wiltshire, on which the principal villages of both periods are marked by different symbols. You will see that while an occasional Romano-British village occurs near a river valley, nearly all are situated on the uplands away from the streams; while, with the exception of a tiny group in the south-east, not a single village of the Saxon kind occurs away from the immediate verge of a stream. There was thus clearly a complete reversal of settlements, and with it, as we shall see, of cultivation systems.

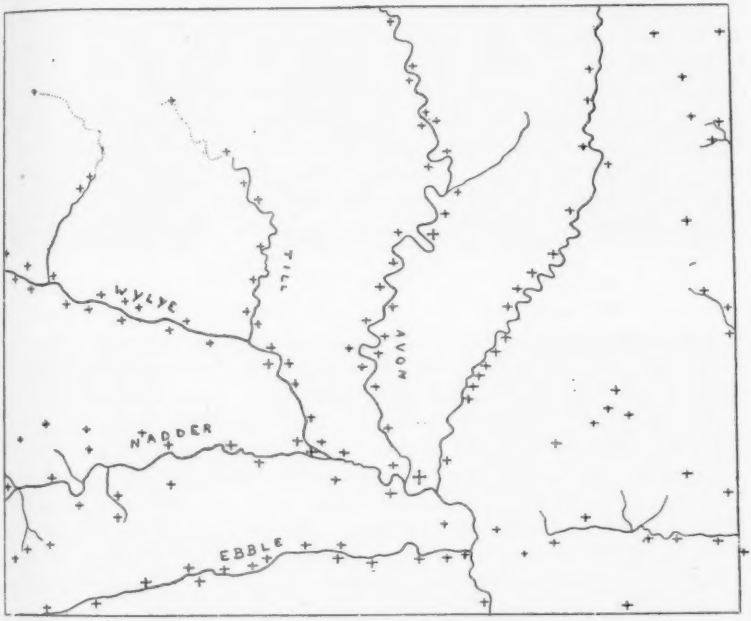
The new system introduced by the Saxons was what is called the



1. Celtic villages on Salisbury Plain.

"open-field system." It lasted, without essential modifications, down to the end of the eighteenth century, and it still survives, I believe, in a few places. I cannot here describe in much detail the complex network of the open-field system, and the basis upon which it rested. At the moment of history when we first catch a glimpse of it in England, namely in the seventh century, it was clearly not a new system, since many of its special technical terms were already in existence, implying that an advanced stage in its evolution had already been reached. By far the best account is that given in the opening chapters of Seebohm's 'Village Community.' Following his example, I will take a typical English

village, that of Calstone, Wilts, and will throw upon the screen plans * of its two open fields. (These plans belong to the Marquis of Lansdowne, and I wish to express my thanks to him and Lord Kerry for most kindly lending them to me, and allowing them to be photographed and used to illustrate this paper.) You will see that the whole area is divided up into long narrow strips; each of these strips would be nominally a furlong in length; but the dimensions and arrangement of the strips were greatly influenced by the topography. Where the normal arrangement was possible, the strips were grouped together in parcels of a furlong



2. Saxon villages on Salisbury Plain.

in length and breadth; these parcels all had names. For instance, in the North Field of Calstone, we find Shady Furlong, Slat Furlong, Racks Furlong, Pontins Furlong; and in the South Field, Peas Furlong, Cake Furlong, Black Furlong, Devises Way Furlong, and so forth. The strips each contained an acre or half an acre originally; and at Calstone several of the furlongs originally contained five acres.†

* Undated; but from the evidence of names of owners of strips they must both be between 1713 and 1732. I have to thank the Rev. E. H. Goddard for this information.

† The following are some of the areas in the South Field at Calstone obtained by adding up the areas on the old map: Great Black Furlong, 4 acres 2 qrs. 27 p. (4);

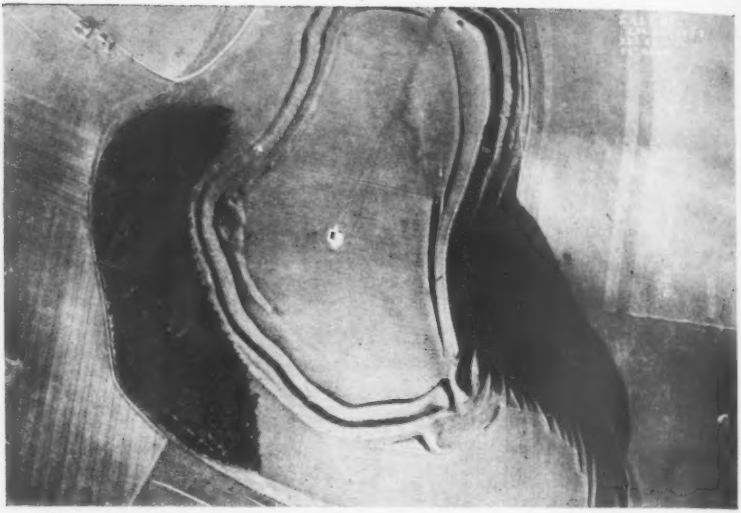
But fortunately we need not investigate these matters nor the peculiar system of tenure involved. It will be enough to call attention to one process which is brought out with great clearness by air-photographs—the formation of lynchets. Hitherto I have used this word to describe the cultivation-banks of the Celtic system. These Celtic lynchets are generally arranged in a chess-board pattern of squares, and form the sides of individual fields. The Saxon lynchets are much longer and occur generally in parallel steps or terraces, arranged one above the other on the side of a hill. The ultimate cause is the same; the difference is due to the different agricultural systems. I will quote Seebohm's description because it cannot be improved upon: "A less universal but equally peculiar feature of the open-field system in hilly districts is the 'lynch'; and it may often be observed remaining when every other trace of an open field has been removed by enclosure. Its right of survival lies in its indestructibility. When a hillside formed part of the open field the strips almost always were made to run, not up and down the hill, but horizontally along it; and in ploughing, the custom for ages was always to turn the soil of the furrow downhill, the plough consequently always returning one way idle. If the whole hillside were ploughed in one field, this would result in a gradual travelling of the soil from the top to the bottom of the field, and it might not be noticed. But as in the open-field system the hillside was ploughed in strips, with unploughed balks between them—no sod could pass in the ploughing from one strip to the next; but the process of moving the soil downwards would go on age after age just the same within each individual strip. In other words, every year's ploughing took a sod from the higher edge of the strip and put it on the lower edge; and the result was that the strips became in time long level terraces one above the other, and the balks between them grew into steep rough banks of long grass, covered often with natural self-sown bramble and bushes. These banks between the plough-made terraces are generally called *lynches* or *linces;* and the word is often applied to the terraced strips themselves, which go by the name of 'the linces.'" In a footnote Seebohm adds: "In some cases on the steep chalk downs, terraces for ploughing have evidently been artificially cut, but even in these cases there must always have been a gradual natural growth of the lynches by annual accretion from the ploughing."

To Seebohm's explanation I would only add that the geological agents of denudation, especially frost and rain, would assist the formation of lynchets; since every tiny movement of the soil would be in a downward direction. The effect of this action upon loose earth un-

Little Black Furlong, 5 ac. 2 qrs. 27 p. (9); Peas Furlong, 5 ac. 2 qrs. 36 p. (5); Lower Furlong, 4 ac. 3 qrs. 34 p. (6); Racks Furlong, 8 ac. 0 qrs. 2 p. (10); Pontins Furlong, 5 ac. 3 qrs. 32 p. (9). The figures in brackets are the number of the strips contained in each as marked on the map. 'Village Community,' pp. 5 and 6 (fig. opp. p. 5).

SCRATCHBURY CAMP, WILTS

QUARLEY HILL, HANTS



BATTLESBURY CAMP, WILTS.

BOKERLEY DYKE, HANTS AND DORSET

protected by any protecting mantle of vegetation, would be rapid and cumulative.

I will now show you a view of the same region as that covered by the old maps of Calstone taken from the air. You will see that the sides of of the valley are covered with terraces—the " strip "-lynchets I have just been describing. This instance is particularly instructive, because we are able, thanks to the existence of these old maps, to identify the actual lynchets which appear so clearly in the air-photograph, with actual strips in the open fields. We find that the two coincide. There can therefore be no shadow of doubt that the lynchets were formed by the operations of a system which was in full working order in the eighteenth century, when the old map was made, and the names of the strip-holders —that is, in some cases, the lynchet-holders—given with the acreage.

The selection of Calstone as typical of the Saxon system has a quite fortuitous advantage. These very same lynchets were observed and recorded in 1796 by a writer in the *Gentleman's Magazine* (p. 821). Sir Lawrence Gomme (' Village Community,' pp. 75, 76) quotes this writer and uses the lynchets as examples of the terrace-cultivation practised by his hypothetical pre-Aryan hill-folk ! In the next paragraph he cites lynchets of the Celtic pattern near Rushmore, with the same intent. Yet the two systems are, as I hope I have shown, as unlike each other as it is possible for two agricultural systems to be.

Examples of the Saxon type of " strip "-lynchets are very common. They are particularly numerous at the foot of the chalk escarpments, and along the sides of valleys. Those I have shown on the screen are on Middle Hill, Wiltshire, between Scratchbury and Battlesbury Camps ; others may be seen in and around the camps themselves, and are clearly much later than the camps. But indeed there is hardly a chalk village in Wiltshire that cannot show some. Lynchets of this type may be seen from the train at Pewsey, and at Shawford in Hants.

The antiquity of the Saxon system was conclusively proved by Seebohm, who demonstrated that it was in existence in the sixth century A.D. So far as I am aware no one has suggested that it originated at any later date, and all those who have studied the subject admit the validity of Seebohm's proofs. There are still some who try to make out that the Saxon system evolved from an earlier system existing in England ; but they do not provide any evidence, for the very sufficient reason there is none ! The upland Celtic villages with their associated field system is a very solid mass of evidence to the contrary. To my thinking it is insurmountable, and puts out of court all *à priori* reasoning on the subject.

I do not, of course, pretend to be the first to demonstrate the Saxon character of lynchets, such as those which occur at Calstone. Seebohm proved that long ago in the case of the lynchets of the Chilterns, and in this I merely follow him. I differ from him in regarding the system to

which they belong as purely Saxon in origin. In what part of the continent it originated does not at present concern me; I merely maintain that it had no connection whatever with the Romano-British—or, as I have called it, the Celtic—system, which appears to have died out completely, at any rate in Wessex.

In order to justify my use of the word "Celtic" here—and I may as well confess that I use it in fear and trembling—I have had three slides prepared. The first shows the system of lynchets over a strip of Hampshire to the north-west and north-east of Winchester. These lynchets have been plotted on impressions of the 6-inch map from air-photographs.* There are gaps in the series, where no air-photographs were available or where the state of the land made the lynchets invisible. But, as you will see, there is enough to give a good general idea of the character of the Celtic agricultural system. The map makes any detailed description superfluous. Let me show you now a plan of some modern Irish fields, selected by Dr. August Meitzen from the Ordnance Map as typical of the Celtic system.† You cannot fail to be struck, as I was, by the close resemblance. In both the fields are normally square or roughly rectangular, and the parcels are grouped in large bundles. Now look at a typical West German settlement (from the same brochure). It is exactly the same as the Saxon strip system, of which Calstone was the type. But it is rather the resemblance of the modern Irish system to the ancient system in Hampshire that I would emphasize. Such a resemblance seems to me to justify the term Celtic.

The main part of my thesis is now concluded, and it remains only to point the moral. I find it difficult to express in suitable words my sense of the importance of air-photographs for archæological study. They provide a new instrument of research comparable only to that provided by excavation. They are second only to excavation in the results they will achieve. Their invention will prove as valuable to archæology as that of the telescope has proved to astronomy. They are *not* a substitute for field work, but they are the most powerful ally of the field archæologist. As a key to the relative age of well-preserved earthworks which impinge upon each other they are unique, and in this the Celtic system of lynchets will be found to be of paramount importance. As a revealer of almost vanished earthworks they are superior in every way to observation on the ground. As an aid to the amateur surveyor of earthworks, they will prove very useful; and it is to be hoped that they will figure largely in illustration of future books which may be written about the earthworks of a country or district. From my own point of view they are priceless. They will save a great deal of time and public money during the revision of the large-scale maps, for they show exactly where

* Checked and supplemented by a good deal of field work.

† Published in a brochure, consisting of plans only, by the 7th International Geographical Congress, Berlin, 1899.

new or suspected earthworks are to be looked for, and thus they save one many hours of fruitless search. They tell one where to go, but, I repeat, they do not save one from the necessity of going there to make sure. There are traps. I wasted a whole day recently—a Sunday—going to inspect some suspicious circular markings visible on an air-photograph near Winchester. They might have been a group of barrows; actually they were due to the circular browsing of tethered goats! Fungus rings also mislead the unwary. I hasten to add that the examples which have been used to illustrate this lecture have been checked by personal inspection and found satisfactory.

To reap the best results there is needed only a large number of air-photographs of regions which are archæologically interesting. Owing to the close connection between air-photography and the archæological work of the Ordnance Survey, it is my hope that a collection may gradually be formed there. The most friendly relations have already been established with officers of the Royal Air Force who have to take air-photographs as part of their regular routine of training. It is hoped that this arrangement may be continued. There is no special urgency in the matter; nor does one ask for anything that would not be done in any case in the ordinary course of practice work. It will be quite enough if, as must happen, some of the photographs taken are taken over what may be called "archæological" districts. In Wessex hardly any selection is necessary, for it is all an "archæological" district (with the exception of some of the Tertiary country such as that round Southampton, and of all thickly wooded country). Other promising chalk regions are the North and South Downs of Kent and Sussex, and the Yorkshire wolds.

So far I have seen only air-photographs of chalk districts. It is here that, from the nature of the soil, air-photographs reveal more than they are likely to in less favourable regions. It is probable, however, that many new antiquities would be revealed by air-photographs of a granite region like Dartmoor and Bodmin Moor. That is one of the allurements of the future. It is equally certain that in a mountainous country like Wales we should learn much about the hill forts and the ancient field systems, not to speak of the smaller stone monuments like burial chambers and hut circles. Here too air-photos will certainly reveal the course of undiscovered Roman roads. But I do not know what the possibilities of flight in such regions may be.

A certain amount of experiment would be desirable, to determine the best lights and heights for taking air-photos. It is however probable that these factors can be judged better by the recipient, who knows what he wants, than by the taker. Such considerations are often of secondary importance, though sometimes a low sun is essential for throwing into shadow banks and lynchets of low elevation. The time of year is more important; photographs taken between January and

May are best, and when the plough-lands are dry, February and March are the best months for air-photography as for field work. For camps good results are obtained at 4000 feet with a 6-inch lens. For lynchets and "wandering" earthworks 10,000 feet seems better. But it would be premature to lay down any hard-and-fast rules about these matters until a larger series has been studied.

Let me make my position quite clear before concluding. My only object in reading this paper is to give an example of the use of air-photographs for archæological survey. I have no ulterior motive. A paper of this kind seems called for to inaugurate what will prove to be a new epoch in the history of British archæology.

Before the paper the PRESIDENT said: This evening Mr. Crawford is to explain to us the great assistance which air-photography is going to be to archæologists. At first sight it may appear that there is no very direct connection between the two, but, with the assistance of lantern slides, the lecturer will, I think, be able to make clear to us the great advantage which the archæologist is going to derive from this new form of photography. A bird's-eye view of the country undoubtedly shows a great many things which are not apparent if you try to observe it from a point of view which is too close to it. The lecturer does not maintain, of course, that air-photography will do away with the necessity of field work in archæology; one method has to be checked by the other. He will be able to make that clear to us, I think, by giving us the result of a personal experience. I understand that he spent the whole of one long day examining on the spot what he expected to be interesting mounds. His day was somewhat wasted, for he eventually discovered that what had appeared in the air-photograph as archæological mounds turned out to be merely marks on the ground made by the circular browsing of goats. That shows that, however useful air-photography may prove to be as an adjunct to field archæology, its productions will still have to be checked by work in the field. I do not propose to anticipate what Mr. Crawford is going to tell us this evening. He will have a good deal to say about the ancient systems of agriculture in this country, as the result of his recent studies. I now have much pleasure in calling upon him to deliver his lecture.

Mr. Crawford then read the paper printed above, and a discussion followed.

The PRESIDENT: We have with us this evening Dr. Williams-Freeman, who has been referred to by the lecturer. He has taken a keen interest in problems such as those which have been discussed this evening, and I have asked him if he would kindly say a few words on the subject of the lecture.

Dr. WILLIAMS-FREEMAN: It is very good of you to give me an opportunity of saying something about Mr. Crawford's paper, because I am quite as much impressed as he is with the very great importance of the use of air-photography in field archæology. Field archæology has always been a hobby with me, and, living as I do close to Salisbury Plain on the Hampshire Downs, I think it would be impossible for an intelligent man to drive about the country and not try to solve the riddle of the banks and ditches which lie all around. The whole of that country is archæological ground, and, by good fortune, it is also good aeroplane ground. What makes it so good for field archæology is, of course, the absence of trees and the quantity of land which has not been cultivated at all or only slightly cultivated; and that is what attracts the airmen. So that

it is very fortunate that, in the ordinary routine of training and taking air-photographs, they can serve our science at the same time. The only quarrel I have with them is that I wish they had not put one of their aerodromes within 200 yards of Stonehenge.

There is nothing in Mr. Crawford's paper that I could say as well as he has said it. The only point that I rather cavil at is this. He said that he doubted whether the Neolithic people had any agricultural system. At least, if he said that, one would agree that an agricultural system such as he has shown us of villages, square fields, and so forth is quite inconsistent with one's idea of the pastoral character of the Neolithic times; but that the Neolithic people had a certain amount of agriculture—that is to say, that with their hoes and wooden ploughs they did scratch the surface of the downs on which they lived—is, I think, almost certain. I think it has been proved on the Continent, from the remains of seeds and plants they have left, that the Neolithic people had some idea of agriculture, and it seems extremely improbable that it did not cross the Channel and that the Neolithic people of Salisbury Plain had no agriculture. But their agricultural system, whatever it was, certainly would not be a system of fields and villages, because those things are not compatible with pastoral life, and we have every reason to believe that their life was pastoral. Their agriculture, their slight ploughing of the light soil, which was suited to their hoes and wooden ploughs, had left, of course, no permanent scar upon the ground. But the other parts of the civilization, not only of the Neolithic people but of those who came after them, have left their scars upon the ground, and it is in elucidating those scars that air-photography will be of such service.

Broadly speaking, it may be said that hitherto we have been obliged to follow out slight boundary ditches and so on simply by observing them from a height of not more than 6 feet above the surface of the ground. One has been helped by the different colours of the soil as it dries off in early spring. At this time of year, or a little later, the sun will be drying all the chalk fields. As you know, a chalk field in the dry summer is light brown, while in the wet winter it is dark brown. It is just as the surface of the soil is drying that one can see the marks of such ditches and banks stretching across the face of the country. In the same way when snow is melting very slight irregularities of the ground are shown up by the bands of thin snow that remain. Then, when the sun is low either at sunrise or sunset, just the least shadow is thrown, and that enables you to trace out on the hillsides marks which otherwise you would completely miss. Things of that sort are all that we have to guide us where the marks are not obvious and coarse and the differences of elevation are very slight. But air-photography gives one an extra chance of seeing things. I remember many years ago at Cranborne Chase driving up to the old Hill-fort of Winkle-bury. I noticed nothing on the hills. As far as I could see the Downs looked perfectly smooth—an expanse of close-cropped down turf. On my way back in the evening when the sun was just westering and casting shadows on the hills, the whole thing below my feet was shown up like a chess-board, with bands running across it in all directions. I remember thinking at the time that one ought to be a bird in order to be a field archæologist. Now we have got our birds, and they can see from the air everything, and a great deal more than one could see by getting up on the top of the hill and looking down at the sides. It is unfortunate, but I believe that the early morning is not a favourable time for photography. The actinic rays are not powerful then, and photographs cannot be taken under the very best conditions; whereas, of course, it is in the early morning and the late evening that the most useful shadows are thrown.

May I give you a few examples of the sort of help that we expect to get, and are getting, from air-photographs? In the big camps like those at Quarley Hill, or at Scratchbury, which the lecturer has shown you, we do not get so much help, because they are great big things with banks rising 17 or 18 feet above the bottom of the ditch, and one cannot possibly miss them. But we find another class of defensive earthworks, or defensive dykes, such as the Wans Dyke and Bokerley Dyke (built many of them by we know not whom, although we are beginning to know as to some of them) running for 10, 20, 30, 40 miles across the country, but lost here and there owing to cultivation and being ploughed away. Air-photography will help us in tracing those dykes. There is in Hampshire, between East Hants and Sussex, a very remarkable defensive dyke which runs for about 4 miles, and which, I believe, will turn out to have been the frontier between Wessex and Sussex during the short period of Anglo-Saxon history when a portion of Wessex was given to Sussex. At a distance of some 3 or 4 miles there is another defensive ditch, though not so powerful as the first. One hardly knows whether to call it a defensive ditch or a boundary ditch; but it is in some places too big for a boundary ditch. It runs for 3 or 4 miles, and one wants to connect the two. If one could do this, the whole thing would fit in at once with what history teaches us about the boundary between those two kingdoms. But the intervening ground is difficult. Some of it is woodland, some of it is arable, and some of it is grass. The fields are not large, and it will take a long time to explore the intervening country by means of field work in order to see whether one can pick up continuity by the view of, say, only 15 or 20 yards of a similar bank running in a proper direction to connect the two together. That, however, will be done, I hope, in one morning by an aeroplane. If a photograph could be taken at a good height under proper conditions of light one would be nearly certain to see a connecting ditch somewhere in the intervening country if such a piece exists. That is the sort of help that can be given by air-photography, and by nothing else.

Then another point of great interest to us is, of course, the barrows—the round barrows, the long barrows, and the very shallow disc barrows. My friends in the Royal Air Force in my neighbourhood have already pointed out to me that during the very dry weather of two years ago certain circles appeared in fields where we had no suspicion at all that there were such things. Some of those fields are quite close to where I live, and I have walked and ridden over them without seeing anything in them. Those circles, or most of them, are no doubt remains of disc barrows, a class of burial tumuli which is extremely interesting from many points of view. Air-photographs will reveal those things.

Then there are those curious big barrows which have been lately called *table barrows;* large shallow circles 80 or 90 yards across, which you are not unlikely to miss as you walk over them because of their size. No doubt more of those extraordinary burial-places, if they are burial-places, will be revealed by means of air-photography. I could go on to mention a great many other points; but the special benefit that I think we may hope to derive from air-photography is the linking up of the mysterious "boundary ditches." Under what sort of civilization, during what period were those boundary ditches made—I call them "boundary ditches," but they may have been roads, and some people think they were—which run for 20 miles across the country? To have organized and made them bespeaks a considerable degree of civilization. What purpose did they serve? They seem to run in what are now quite inexplicably objectless directions, wandering about, sometimes cutting across each other, and some-

times running parallel; not running between camps so as to divide the territory of this tribe from the territory of that tribe, and not always running from one camp to another, but radiating from the camps in different directions as if they were roads. Yet one would like to know why and by whom roads were deliberately made with a shallow ditch in the middle and banks on each side? The whole thing is so difficult to explain and so mysterious. Being, moreover, comparatively shallow things, with banks which are, perhaps, only a couple of feet high, they have disappeared for such long lengths that one cannot see on the ground—literally on the ground—how to connect them all up. It will be different in the air. We shall have little lengths and then gaps which the air-photographs will enable us to fill up by showing the connecting links. In that way we may arrive at what they were and, eventually, at who made them.

Then there are other roads which run, for instance, across Hampshire. I am thinking of a roadway called the Lunway. Everybody knows it. It runs for about 4 or 5 miles across the Downs; but where it began and where it went to no one knows. It has a name which was evidently in use in Saxon times, and that name, "Lunway," has stuck to it. It is a mysterious bit of road. Air-photographs will probably show us traces of that road running for miles to the east and west, and, very possibly, show us also the points of interest through which that road passed. There seems to be hardly any limit to the help that air-photography is going to give to field archæology. As a field archæologist, may I take the opportunity of thanking the Royal Geographical Society for admitting this humble sister to her halls? The paper which has been read is largely archæological and very slightly geographical, though of course such problems as I have hinted at—the elucidation of the boundaries of ancient civilizations, of ancient sites, of ancient tribal arrangements, and so forth—are really problems of Geography.

The PRESIDENT: I have no doubt you would like to have a few words from Sir Charles Close, who, when Director-General of the Ordnance Survey, revived in that Department an interest in the archæological side of its work.

Sir CHARLES CLOSE: I think everybody will agree that Mr. Crawford has abundantly proved his main contention that the field archæologist has much to gain in future from an alliance with the air-photographer, particularly in England. If I may say so, the Ordnance Survey will have much to gain, as we may reasonably hope, under Colonel Jack's admirable direction, as a Department, from a very close alliance with the Air Force in matters archæological. I do not think it was realized some years ago how much could be done in that way, although we have all heard stories of people getting to great heights and seeing marks that were not otherwise visible. For instance, those who have served at Gibraltar will remember very well that if one got to the top of the Rock towards the north front, one could see the remains of the old Spanish lines, which are invisible when one is down near them. Long before aeroplanes were thought of there was a form of air-photography in use. As far back as 1880 balloons fitted with automatic cameras were sent up, and much good work was done (by the late Colonel Elsdale). I am very glad that the Ordnance Survey should be so closely concerned with archæology to-day. It is many years since those who started the Survey first took up that subject. William Roy, the first real founder of the Ordnance Survey, who made the first map of the Highlands in 1747, was an enthusiastic archæologist and wrote a well-known book on the military antiquities of Britain. Then, a little later, Thomas Colby, who might be called the second founder of the Ordnance Survey, gave as one of the reasons for the making of a large-scale survey of Ireland, that it

would materially help to improve our knowledge of the archæology of Ireland, a subject which I believe is still in backward condition. I will not elaborate that contention now, but I will repeat what I have said already, that it is certain that the Ordnance Survey has much to gain from an alliance with the Air Force in this matter, and in the competent hands of Mr. Crawford, I am quite sure the Department will take full advantage of the opportunity.

The PRESIDENT: Dr. Eliot Curwen has been working on parallel lines with Mr. Crawford, and, as he is present here this evening, I will ask him to say a word or two upon the subject.

Dr. ELIOT CURWEN: The lines on which my son and I have been working are parallel, in a sense, to those which Mr. Crawford has followed. We however have been working on the ground, and have had nothing to do with air-photography. From the observations which we have made in Sussex we have come to the same conclusion as Mr. Crawford has arrived at as to the period to which those square chequer-work lynchet fields, with associated field-ways, may be attributed. We believe that they were in use during a very extended period, on account of the various types of pottery which are found in the banks, or immediately under the turf on the banks that constitute the lynchets.

Immediately to the north-east of the camp at Cissbury there is a very fine specimen of a Celtic road—a bi-vallate road, consisting of a central ditch with a bank on each side. Leading off it, like a diverticulum, there is what we believe to be what the Romans called a Circus—a place of communal meeting, or, as we should say, a folk-moot. We assumed that the village would be hard by. Subsequent exploration has proved this expectation to be true. Running up to, but not across, this Celtic road are the lynchet banks of a field system—a system consisting not of the long strips which the Saxons used, but of square or rectangular lynchet fields. Lower down the hill there are the remains of a building of the Roman time, and scattered in various patches over the whole area we find pottery of many dates. One piece of terra sigillata bears impressions showing that it belongs to the 3rd Lezoux period (A.D. 150–200). Close by the Circus was the village. The remains of some of the huts have been excavated already. A bottle-shaped store pit, about 7 feet deep, has been opened up and found to be filled with all sorts of rubbish. From that rubbish has been turned out a quantity of good-quality, hard, burnished pottery of a hæmatite colour, which is attributed by those who understand these things to the Hallstatt period. Moreover, from that same pit has come a conical spindle whorl of a sort known, I believe, as the Troy type—a type characteristic of the Hallstatt period. So it looks as if that site was occupied during the Hallstatt and La Tène periods, or possibly during the transition between the Hallstatt and La Tène I. period—if the former existed in Britain.

But more conclusive evidence still is to be found in the six or seven circular platforms which have been dug in the hillside between the lynchets, in form very much like flat circular putting greens on a golf course. There are six of such platforms in one field. There is the lynchet slope above the field and the lynchet slope below. These platforms are sharply cut. They have not been ploughed over; they would not be so sharp-cut in their edges if they had been. Therefore they were constructed after that lynchet field had been formed by ploughing; and not merely that, but after it had gone out of cultivation. In these platforms, in the earth which the rabbits have kicked out of them, we find pottery which is attributed to the La Tène I. period, which goes back, as Mr. Crawford has told us, to what is commonly considered to be the earliest period of the Iron Age in Britain—about 450 years before Christ.

If these observations that I have detailed are correct, those platforms were made subsequent to the formation of the lynchets; that is to say, the lynchets were made before at any rate the end of the La Tène I. period. Further than that we are not able to take them. We have no definite proof that such lynchets go still further back. We do not doubt that Bronze Age man grew corn; but in archæological research we try not so much to hazard opinions as to obtain definite evidence and facts, and we have not found, so far, definite evidence of the existence of areas on which Bronze Age man grew his corn. That, of course, is very far from denying that he cultivated the soil; but we have not yet found evidence to enable us to discover the ground on which Bronze Age man or, of course, Neolithic man, grew his corn.

I do not think I can better conclude than by saying how grateful we should be in Sussex if Mr. Crawford and his friends with the aeroplanes would come and help us to elucidate many of the problems we have to tackle on our chalk Downs, which, though much smaller in area than those to the west, are none the less important.

Colonel WINTERBOTHAM: Photography from the air is not the only subject that one associates with Mr. Crawford's archæology. During the war of 1914–18 it was one of the duties of the Field Survey Battalions to take panoramic photographs from points of vantage near the front-line trenches. These photographs, taken in conjunction with the map, were the basis upon which plans for subsequent attacks were made. Mr. Crawford developed an extraordinary aptitude for taking these photographs and displayed such an enthusiasm for unhealthy places that one wondered, until one came across a large bag full of flint implements which he used to find in the Somme trenches in the course of his duties.

With regard to the actual subject of the lecture, the photographs which were shown to us were excellent. They were wonderfully clear examples of the way in which air-photography integrates, as it were, those small marks on the ground which outline an old work or part of a work, and brings them to one's eye as a whole in a fashion which one could never get from the ground itself. If that is so, it means that the work of the mapper and the archæologist can be done from the same evidence; and in countries less well mapped than our own it will be an additional reason for taking photographs. That will help both the surveyor and the archæologist. In reference to certain new countries it may be objected that archæology is not a matter of paramount importance. But in looking at those photographs to-night it struck one that although they supplied most interesting evidence about these ancient peoples, that evidence would have been far better had they taken the photographs themselves in connection with their own activities. One can, therefore, see the advantage to future generations of the photographs taken to-day. If it is not for archæology, then for statistical purposes one can see that such photographs will be invaluable.

Mr. O. G. S. CRAWFORD: I must thank you all for your kind reception of my paper. I must also thank those members of the Royal Air Force who took the air-photographs. Without their hearty co-operation it would have been impossible for me to have shown you any slides at all.

The PRESIDENT: May I on your behalf and my own, thank Mr. Crawford for his paper this evening? He has shown us some excellent examples of photographs taken from the air. It is a somewhat solemn thought that in the year 1923 A.D. we can take from the air photographs of the agricultural systems prevalent in this country some 500 years before Christ. Mr. Crawford's ex-

perience of air-photography has not been confined to archæological work in this country. He also had experience of similar work during the war over the German lines and for some ten months I believe he enjoyed the enforced hospitality of the German people. We are all delighted to think that he has returned safely from that experience and is now at liberty to carry on the excellent work of research which he is doing on behalf of the Ordnance Survey of this country.

THE LIVINGSTONE MONUMENT AT CHITAMBO

THE most notable object in the Society's Museum is the section of the tree under which Livingstone's followers buried his heart, and on which they carved an inscription before they bore his body to the coast for burial eventually in Westminster Abbey. In 1899 the Society had received news from Mr. Weatherley that the tree was in bad condition, attacked by rot and by borers. It was resolved therefore to remove the inscribed portion while there was yet time to preserve it, and to erect on the site an obelisk that should be a more lasting memorial of the explorer.

Sir Alfred Sharpe, the British Commissioner in Nyasaland, undertook to act as agent for the Society in this enterprise, and he commissioned Mr. Robert Codrington, representing the British South Africa Company in the Bangweulu district, to take the necessary steps. Mr. Codrington's account of his journey to Old Chitambo for the purpose is printed in the *Journal*, vol. xv. p. 227 for March 1900.

Meanwhile by the efforts of a joint committee representing this Society and a body of residents in Nyasaland, who with the support of Stanley had begun an independent effort, sufficient funds were raised to build a memorial which is thus described in the *Journal* for June 1900, p. 637 :

" It has been decided that the memorial shall take the form of an obelisk, 20 feet high, surmounted by a cross. In the absence of suitable stone in the region in question, the material chosen is the best concrete, which, it is thought, will be the most satisfactory from the point of view of durability. It will be taken out in 450 air-tight cylinders, each of 50 lbs. weight. Moulds, of oak with metal lining, have been prepared for the formation of the blocks, of which over 300 will be used. Tablets, in blackened bronze, will be embedded in the blocks as moulded. Two of these, placed on opposite sides of the monument, will bear the following inscription : ' Erected by his Friends to the Memory of Dr. David Livingstone, Missionary and Explorer. He died here, May 4, 1873.' On the other faces of the obelisk two more tablets will be placed, on which the following will appear :

> "This monument occupies the spot where formerly stood the tree at the foot of which Livingstone's heart was buried by his faithful native followers. On the trunk was carved the following inscription: 'David Livingstone. Died May 4, 1873. Chuma, Souza, Mniasere, Uchopere.'"

The plans thus made were not carried out exactly. Instead of making the obelisk of moulded concrete blocks built up in gradually narrowing courses as shown in the sketch on p. 638 of the *Journal* for June 1900, it was built by Mr. Codrington of "well-burnt bricks thickly coated with cement," and the "considerable balance from the sale of the cement not needed for the work" was to be expended on building a Livingstone Memorial Hospital at Fort Jameson (*Journal*, vol. xxi. p. 454, April 1903). A photograph there reproduced shows a smooth cemented obelisk—stouter and perhaps better proportioned than in the original design—surrounded by four concrete posts and slight wooden rails.

A few months ago Mr. W. J. W. Roome, Secretary for East Central Africa of the British and Foreign Bible Society, called at the House of the R.G.S. and related that he had some little while before learned that the monument needed repair. Now this Society holds in trust the unexpended balances of the fund raised for building the monument. It is represented by £198 1*s*. 3 per cent. Local Loan Stocks: and there is accumulated interest amounting to £99 5*s*. The Council therefore instructed the Secretary to inquire of the British Commissioner at Serenje what should be done to put the monument into repair.

He replied suggesting that, as there were now masons available at the Livingstone Mission at Livingstonia, and good building stone in the neighbourhood of the monument, it might be well to remove the defective cement and encase the brick core with masonry. The bronze plates bearing the inscriptions had lost some of their letters, which were not cast but said to be screwed on: and the plates required renewal. He thought this might easily be done, as there were spare plates which had been stored at Fort Jameson since 1902, one of which had recently been brought to the Mission. Mr. Cookson, the Commissioner at Serenje, promised that he would ask Mr. Moffat of the Livingstonia Mission to make a further report on his return from leave.

We have just received from Mr. Cookson a further letter embodying the following report from Mr. Moffat:

> "The monument itself is not in bad repair. It only needs a thin coat of cement to put it in good repair. It has stood well—there are some small cracks in it but nothing serious. The two plates on the Monument, one on the east side and the other on the west—are what need attention. Seven of the letters have dropped off. These were soldered on, and the solder has weathered. I have these seven letters and think I can manage to solder them on in their

places. It was a pity the plates were not solid with the letters embossed. It was only one plate that you got through from Fort Jameson last year. The other plate is still over at Fort Jameson. The inscription on the plates that are on the Monument is :

Erected by his friends to the memory
of David Livingstone, Missionary and
Explorer. He died here May 4, 1873.

The inscription on the plate that is here is :

This Monument
* —ccupies the spot
where formerly stood the tree
at the foot of which
Livingstone's heart was buried
by his faithful native followers
on the trunk was carved
the following inscription
David Livingstone died May 4, 1873
Chuma, Souza, Mniasere, Uchopere.

I take it that the other plate at Fort Jameson bears the same inscription, and that the plates were intended to be fixed on the north and south sides of the Monument. Then there is the rail round the monument. At present it consists of four small cement pillars with telegraph poles let in somewhat like this :

[*Diagram not reproduced.*]

On the west side there was no rail. It originally had a wooden pole which was burned. Judge Beaufort years ago sent another telegraph pole for this side, but it was a few feet too short. When I was last out I fixed it up with a pole, but Mr. Draper sent me some old gun barrels, and with these I was to try and fix it up; but what it really needs is a decent iron rail all round. I expect to be going out next month with Mr. Ashcroft, and will take out the letters and see if I can get them soldered on."

This letter reveals the curious fact that the second pair of bronze plates, intended for the north and south faces of the monument, were never fixed in position but have been lying at Fort Jameson until one has lately been taken to Livingstonia. The plates which Mr. Cookson in his first letter spoke of as spare plates available for renovation of the monument prove to be not duplicates but originals which miscarried for some reason not at present traced. It should be noted that the inscription on them is not quite correct; it misquotes the words originally carved on the tree, which are :

DAVID LIVINGSTONE
MAY 4, 1873
SOUZA, MNIASERE,
CHUMA, UCHOPERE.

It seems clear that the first two things to be done are to have the

* Letter "o" missing.

THE LIVINGSTONE MONUMENT AT OLD CHITAMBO, 1922

Phot. W. J. W. Roome.

THE MANGO TREE ON THE BEACH AT UJIJI, WITH CONCRETE BENCH ERECTED BY THE BELGIANS TO COMMEMORATE THE MEETING OF LIVINGSTONE AND STANLEY ON THIS SPOT

Phot. W. J. W. Roome.

plates properly cast with solid letters and to erect a substantial railing. Whether the monument should be carved in stone by local masons, or the cement repaired, depends partly on local experience of the relative durability of cement and masonry, but more upon the question how much money will be available.

The accumulated interest in the hands of the R.G.S. is perhaps enough for recasting the plates and repair of the railing, but evidently not enough for facing in masonry. It would seem desirable to preserve intact the capital sum, to provide for future maintenance.

On the 4th of this month of May is the 50th Anniversary of Livingstone's death at Chitambo. It may well be that admirers of his deathless work, and friends of the Livingstone Mission, would wish to see that Anniversary marked by a thorough restoration of the monument. The President and Council of the Society will be glad to receive any donations for this purpose and apply them, with the money already in the Society's hands, to the renewal and improvement of the monument after further consultation with the Commissioner at Serenje and the members of the Livingstone Mission.

If sufficient funds are available there is another memorial to be completed. An old mango tree on the beach at Ujiji marks by long tradition the place where Stanley saluted Livingstone with the famous inquiry. On the occupation of Ujiji by the Belgians they constructed a concrete bench round the tree to mark the place permanently. But it has been found since then that the concrete was pressing the roots and killing the tree, so that the British Commissioner at Ujiji, Mr. Longland, has with regret deemed it necessary to remove the bench, and is anxious to replace it by a cairn or monument with a suitable inscription.

THE 1/MILLION MAP OF SPANISH AMERICA

THE Hispanio-American Division of the American Geographical Society has just published the La Paz sheet: first of a series of maps of Spanish America on the scale of 1/M which are to conform generally to the Paris Resolutions (1913) for the *Carte du Monde au Millionième*, and have received the blessing of the Central Bureau at Southampton, yet are not to be accepted altogether as part of the International Map, because they fail in one important respect: the sheets are not produced officially by the States having the greatest interest in the territory they cover. They form in fact a pirate series analogous to the series of Europe and the Near East which we compiled at the R.G.S. during the war for the General Staff; but with this difference, that the American enterprise is undertaken in cold blood. Rightly or wrongly the American Geographical Society has abandoned any hope that the Governments of Latin America will produce their own International

Sheets within any reasonable time, and have resolved to do it for them. The La Paz sheet is the first-fruit of the enterprise: its publication should therefore be considered on general principles, apart from the merit of the individual performance.

At the Paris Conference of 1913 there was an amusing debate on the question of authorizing a country not interested by sovereignty to produce sheets of the International Map, if it appeared that the State immediately responsible was unable or unwilling or unlikely to do so. Russia and Japan contended for the right to make the 1/M sheets of China: whereupon a Chinese Secretary of Legation, to the admiration of all hearers, declared that he was authorized by his Government to announce that Geodetic and Topographical Services were now operating regularly in all the provinces of China. So there was nothing for Russia and Japan to do in the matter.

We suppose that if the American Geographical Society had formally asked authority to produce the sheets of Latin America it could not have been granted. The Argentine Republic long ago published three sheets, a little primitive in execution but a good augury that has not been fulfilled. The Brazilians announced about 1916 their intention to publish at least a part of the 25 sheets or so covering their immense territory to celebrate the centenary of independence. But the task proved too large for the time, and the map will, we understand, be published on the scale of 1/ 2M. The remaining states of Central and South America showed no real signs of beginning. So there was in effect, if not quite legally, an open field for the enterprise of the American Geographical Society. They make no claim that the map is the official International Map, and while they report to the Central Bureau, they do not feel bound by the Paris resolutions, which however they follow pretty closely in their first attempt.

Geographers who are not required to take a strictly official view will heartily welcome the enterprise, which has much in its favour. Experience shows that nothing is more difficult than to produce in one office but at different times sheets which really conform to the International model so exactly that they can be fitted together, without discontinuity in layer colour, or strength of conventional signs, or gauge of lettering. It is almost hopeless to expect that offices in different countries will succeed. An individual sheet may seem to conform very closely to the Resolutions: put it alongside the adjoining sheet produced elsewhere, and the effect is disastrous, because a bad match looks worse than a contrast. It seems that the only chance of getting sheets which can really be joined together is to produce them under the same hand: and it is hard enough even then.

The first advantage, then, of a mildly piratical but most meritorious enterprise is that we ought to get sheets of South America that will join up with fair success; but this only on condition that the producers keep resolutely to the pattern with which they start. The La Paz sheet

covers a great vertical range, from the sea to the summits of the Andine Cordillera. With its publication the die is cast. There must be no tinkering hereafter with the vertical interval between contours because on some other sheet they get too crowded ; no scrapping the fine gradation of layer tints because thirteen or fourteen printings seem on experience too costly. The first advantage of the wider enterprise will be lost if it does not bring more perfect uniformity of style.

The second great advantage of the American Geographical Society's scheme should be regularity of progression sheet by sheet. There are at present no two consecutive sheets of the strictly International Map for the Continent of Europe, and in the present state of Europe small hope of progress. The provisional 1/M series for the time being provides a rough substitute—full of defects, because it was made in a great hurry under the stress of war, but vastly better than nothing at all, and solid as far as it goes, with no exasperating gaps. Any International scheme is weak, because there is no effective power to encourage or compel the steady completion of the map sheet by sheet. Hence there has always been a tendency for people of resource to " butt in " with sheets that did not properly belong to them. The very first sheet of the International Map ever published was that of Istambul, issued by the Geographical Section, General Staff, who followed it up with Kenhardt (South Africa), but then went off to East Africa. And after that the war came to stop any further regular progress.

In the present state of the world, and of national finances, the best hope for the 1/M map is therefore that it should be taken up in broad and comprehensive schemes such as that of the American Geographical Society. Few institutions have the means at command to engage the necessary staff of compilers (whose functions are sometimes overlooked or confused with those of the draughtsmen). Not all Government institutions have the trained staff of scientific assistants to deal successfully with the problems of transliteration or classification of place-names, to search out-of-the-way journals for travellers' sketch-maps, or to select material with due regard to political and geographical history. Nor could rival institutions working independently preserve the balanced uniformity in these matters which is essential to real success.

Therefore we wish the new venture of the American Geographical Society every success, believing that such an enterprise has on the whole the best chance of realizing the aims of the International Map, though at some little sacrifice of its internationality.

A. R. H.

A COMPLETE MOUNTAINEER

Below the Snow-line.— Douglas W. Freshfield, D.C.L. London: Constable & Co. 1923. *Maps.* 18*s. net.*

AMONG the many obligations under which Mr. Freshfield lays his readers in these charming sketches of varied mountain wanderings 'Below the Snow-line,' not the least is his reminder—to many it may be almost a revelation—that "there *were* mountain-lovers before the last century; that Rousseau and his successors were not the *first* to express in adequate language—much less to create—the feeling for mountains we often call modern." In the illuminating paper on 'Mountains and Mankind' which formed his address as President of the Geographical section of the British Association at Cambridge in 1906, Mr. Freshfield developed with most convincing fullness and lucidity the proposition that "the love of mountains, so far from being a taste, or—as some would have it, a mania—of advanced civilization, is on the contrary a healthy, primitive, and almost universal human instinct." It was, as a matter of fact, mainly to the naturalists of the Zurich school of the sixteenth and seventeenth centuries that the renewal of the primitive friendship between man and mountains was in the first place due.

Writing as early as 1543, Conrad Gesner, "the morning star" of true mountaineering, tells us with engaging frankness of his great love of mountain-climbing for its own sake, and that he had registered a vow "to ascend divers mountains, or at least one every year," so long as God should grant him life. "For there is no pleasure," he maintains, "choicer than that of the mountaineer. Give me a man of reasonably good complexion in mind and body; not the slave of indolence, luxury, or passion. I would have him, likewise, a curious admirer of nature, so that by beholding and admiring the mighty works of the Master Workman, and the variety displayed in one mass among the mountains, delight of the mind should be added to the harmonious delight of all the senses. What entertainment, I ask, can you find in this world, so worthy, so high, and in every respect so perfect?"

The writer of the work before us appears to satisfy completely Gesner's requirements for the mountaineer after his own heart, and his book, together with that of his friend and colleague, the late Lord Bryce, offers us a gallery of sketches of mountain travel and scenery that embraces most of the chief mountain ranges of the world. If Lord Bryce was fittingly entitled "An ideal traveller," our author no less deserves distinction as "A complete mountaineer." It is true that, from the athletic point of view, climbing for him chiefly finds a place as a means of locomotion to heights whose ascent is desirable for the sake of the prospect gained of fresh country or of new aspects of familiar landscape. Yet, when occasion needed, he showed a fleetness of foot wholly out of the ordinary, as when, in an "uphill race with autumn mists" on the Croisse Baulet above Sallanches, a vertical height of 3316 feet was ascended in 75 minutes. Or when descending a snow gully from the top of Taygetus he did so by "a very rapid act of snowmanship" which was thus described by his startled Greek guide, "The Englishman stepped on to the snow, flew off suddenly like an Athens tramcar, and disappeared out of sight. I thought him mad, but half an hour later I found him sitting at the foot of the mountain, apparently none the worse." With this physical activity is combined a mental agility that at once seizes on the salient features of each fresh landscape, and on the choice of the *mot juste* which so accurately pictures the new prospect or vividly recounts every novel experience. His wide experience of mountain

travel in all parts of the world enables him to maintain a sense of proportion and to employ comparison with exceedingly illuminating effect. It is the combination of these varied gifts with sound classical scholarship that has made Mr. Freshfield's name almost as familiar among Continental mountaineers as it has long been in his own country, all of which was charmingly expressed in the *Echo des Alpes** some years ago: "De toutes ses forces, il admire la montagne, mais cette admiration n'a rien de platonique, elle se double presque toujours du 'how to get in' caractéristique du coureur des sommets. Pour avoir atteint les cimes les plus hautes, il n'en méprise point les régions de moindre altitude; il s'attarde voluptueusement dans les massifs secondaires que d'aucuns déclarent insignifiants. C'est que partout il discerne une beauté dont il s'éprend; sous tous les climats, à toutes les altitudes, la montagne, pour lui demeure immuablement belle."

Mr. Freshfield had the enviable advantage of being trained in the art of mountain travel from childhood under the guidance of one singularly gifted and observant, from whom he inherited an ardent love of natural beauty. Interested critics have speculated, in their reviews of this book, as to when the various sketches included in it were originally written. The answer is to be found, with one exception, in the pages of the *Alpine Journal*, but it will demand research through the records of half a century. His first Alpine volume was published not long after leaving Eton for Oxford, and deals with a delightful journey 'Across Country from Thonon to Trent.' And it is not for nothing that a book written so early should now only be procurable—*when* purchasable—at a price far beyond its own weight in silver!

We now turn to the text itself. Sub-alpine walks in the Alpes Maritimes take us through scenes familiar to many mountain lovers in that region, but the pictures of them are often rendered from a quite original point of view, and after his description of the flowery meadows from which one looks up through the budding branches of the chestnut in fields already high with maize, to the gleaming glaciers far beyond and above, we do not wonder at the writer's predilection for the Maritime Alps in the full glories of their autumn colouring and atmosphere. In Corsica we follow him, with his friend and companion of Alpine wanderings and of travel from Poti to Oran (François Dévouassoud), to the summit of Monte Incudine, whence we are greeted with the loveliest prospect that Corsica has to offer, the description of which recalls the view from the famous spot in the hills between Yokohama and Kamakura—*Fude-sute-matsu*—"The pine-tree where the brush was flung away" by the old-time painter despairing of a task at last beyond his powers. The scenery of Corsica is painted for us by Mr. Freshfield as "not in the least stern or savage; it is rich, splendid, shining, romantic." It is pleasant to find him as friendly and appreciative with "the honest and intelligent" Corsicans as with the "courteous and helpful peasantry" of Alpine Japan, or the cheerful and willing porters in the sodden forests and foothills of the Mountains of the Moon.

While the ascent of the loftiest peak of the Apennines—the Gran Sasso—reveals "a striking scene with a wild savage character of its own, unlooked for so far south," a different prospect greets us in the mountains of Carrara—beloved of Ruskin. "Above the waters of the 'soft blue Spezzian bay' they thrust themselves out of an unchanging belt of grey olive woods, a cluster of keen sword-blades, in winter white with Alpine snows, in summer golden in the sunshine with the warm hues of weathered marble, purple in the shade with the rich bloom of a southern atmosphere."

* The monthly publication of the Swiss Alpine Club.

Perhaps the most suggestive of the whole series of sketches is that of 'Classical Climbs,' on account of the new light it throws on the scenery of Greece, of value alike to student, geographer, and mountaineer. "The diversities of landscape in Greece correspond to its ancient divisions. They were the cause of those divisions. The trend and height of its mountain ranges, the complexity of its coasts, severed the communities from one another, inclined them to remain separate states, forced the inhabitants to become sailors and traders. A study of the natural surroundings of the Greeks is the clue to their history." It is somewhat of a bathos to hear the railway porters call out "Mycenæ" or "Argos" as one is dragged up to Arcadian heights in a very modern train, and to find that "the town of Sparta is a modern affair, a straggling garden city with many detached houses, unpaved lanes, an untidy street of stores." We are shown how "Pelion, a massive green mountain, rises straight out of the waves: Ossa, a shapely pyramid, stands up alone: Olympus shows as a huge broad-shouldered mass, on the upper slopes of which the bright mists continually gather, parting for a few moments to reveal a white snow-ladder which Hermes might have found suitable for a glissade to the lower world."

The human interest is seen at its strongest in the Kabyle Highlands, which we find can in May be as bleak as Braemar, while at Biskra it is as warm as Cadenabbia. Offences hereabouts are punishable by fines paid in butcher's meat, and it is suggested that the sword of justice is sometimes sharpened by the appetites of the judges. Whoever kills an ox or a sheep must reserve certain joints for the Unemployed and Incapable. A hospitable Kaid, apologizing for the absence of absinthe, was startled by the guide's declaration that "The stranger is *not* a Frenchman—for he drinks no absinthe and walks like a Kabyle"! Close contact with pastoral life is afforded in the scene presented at the night quarters occupied before the ascent of Jebel Jurjura. "The donkey, as a more sociable being (than the cows), and nearer to humanity, was privileged to stand within the stable passage with his forequarters in the room, where he could see all that went on and join in the conversation, a privilege of which he took undue advantage. A cat—François declared, a two-legged one!—ate our fowl, and we were reduced to some very bad kouskous for supper." Nevertheless, Mr. Freshfield, in spite of all, can allow that "It is something to be able, on the third day after leaving Charing Cross, to be discussing kouskous in the Homeric simplicity of a Kabyle village."

Suggestive reflections in "By-corners in Savoy" afford fresh ideas as to the most repaying ways of really *seeing* Mont Blanc, as well as reasons for the failure to do so on the part of the much-doing, much-done tourists whose dust-cloud "rolling along among the poplars of the plain veiled their strange pilgrims' progress."

We learn that no less than 150 years ago there were three hotels in Chamonix, the visitors to which rose to as many as 1500 in a season. The striking situation of the burial-place of Marc Bourrit, "the historian of Mont Blanc," above Sallanches, excites admiration, but doubt is cast on the veracity of that worthy's statement that he first saw it when running *after* a wolf—for his truthfulness is well known to have been frequently outstripped by his enthusiasm!

Disheartening as was the "always detestable" weather which ruined the Ruwenzori expedition—"We had hoped for mountaineering . . . we found ourselves mudlarking"—it failed to damp his interest in the strangeness and novelty of the swampy tropical forests, and he notices how the glaciers are

Pyrenean rather than Alpine in dimensions and character, but may compare favourably with the ice north of the valley of Chamonix on the Buet and the Dent du Midi range.

A wise and well-timed warning is uttered in the penultimate chapter on 'Byways in Japan' against the misleading and superficial complaint of the globe-trotter that "Japan has been spoilt." As the only European mountain traveller of eminence to leave the beaten tracks and to penetrate into and to describe the scenery of the heart of the Japanese Alps, Mr. Freshfield's impressions are all the more valuable and suggestive. The climb out of the Kōfu plain through the foothills of Fuji-san reminded him of "a bit of Tyrol warmed with the colour of Japanese life and atmosphere," while, further north, the distant prospect of the Northern Alpine chain from Matsumoto recalled, in general effect, the Maritime Alps, or the Bergamasque Alps seen from the plain of Lombardy. In these regions a vivid impression was left of the great influence of an excessive rainfall in modelling the surface of the hills. While the loftiest crests of the snow-seamed ridges rising to a height of 10,500 feet are often wild and rugged and often extremely varied in form, the "distinctive charm lies rather in the wooded gorges with their exquisite combination of crags and brilliantly coloured foliage." A charming compliment was paid to the author at a banquet whereat he was entertained by the Japanese Alpine Club, when his health was proposed in the following terms: "One has come down to us from 20,000 feet, but the love of Beauty and Pure Colour will soon carry back the mountaineer to his proper sphere."

May we hope that in the next edition of these fascinating sketches Mr. Freshfield will see his way to include the paper dealing with 'Mountains and Mankind,' read in the light of which their value and their charm will be enhanced.

WALTER WESTON.

REVIEWS

EUROPE

Poor Folk in Spain.— **Jan and Cora Gordon.** London: John Lane. 1922. *Price* 12*s.* 6*d.* net.

Footprints in Spain.— **Lieut.-Col. H. A. Newell.** London: Methuen & Co. 1922. *Price* 10*s.* 6*d. net.*

Madrid Past and Present.— **Mrs. Steuart Erskine.** London: John Lane. 1922. *Price* 7*s.* 6*d. net.*

THESE three books on Spain appear simultaneously but differ widely in their purpose and execution.

Jan and Cora Gordon are two artists who set out with a war gratuity of £120 to seek, as they put it, "for our original selves . . . for something that the war has taken from us," and their book is not "about Spain in the true sense of the word: it is a book about ourselves." (So was Borrow's book, but he called it 'The Bible in Spain.')

The reactions between the authors and their human environment have interest, but not a sufficient interest to carry the book successfully over 276 pages. Nevertheless the characters in the book are full of life and the descriptions of the scenery of the Murcia and Alicante districts, where most of the authors' time was spent, show the painter's quick eye and sense of colour. The book is disfigured by glaring mistakes in Spanish.

This last criticism may be applied still more strongly to Lieut.-Col. Newell's book, in which the place-names and fragments of Spanish are often inaccurately reproduced: thus the photograph of a lane in Elche appears with the legend *Comimo del Castano*.

Colonel Newell has "little attention to spare for the inhabitants": wherever he goes it is "not modern Spain that appeals to him, but that mighty Empire of the past, which strews the entire Peninsula with monuments." The result is a book full of what the Gordons explicitly eschew as "second-hand history," and which Mrs. Steuart, as we gather from her introduction, would describe as "competing with the official guide-book." This is the more to be regretted as the author has a good eye for scenery, and the far too few descriptive passages —the opening passage, for example, on the approach to the Roussillon—are excellent. Colonel Newell had the distinction also of being the last foreigner to see the body of the Cid.

Mrs. Erskine sets out to explore and describe the by-ways of Madrid, and introduces us in passing to the artistic treasures of which Madrid is full, and to many of the people who have written on artistic subjects in the past and present. She is particularly interesting on tapestries and in her notes on the Art and Industry of the present day. There is a fascinating chapter on the "*Plaza Mayor*." We get a clear picture, too, of the enthusiasm of the workers in artistic and educational circles who desire a closer *rapprochement* with our own country. It is regrettably true that we have been less quick than France and America to respond to this desire, nevertheless King's College, London, is working steadily in this direction, and Mrs. Steuart will be glad to know that her friend, Don José Castillejo, comes to lecture there next year.

It is a pity that a seriously conceived book should be so full of grammatical blemishes; the accentuation of the Spanish words is hopelessly inconsistent, and "*hijosdalgos*" (p. 106) is inexcusable. R. A.

Hadrian's Wall — **J. Mothersole.** London: John Lane. 1922. *Illustrations.* 8*s.* 6*d. net.*

This little book has slight claims to be regarded as either science or literature, and the pictures leave much to be desired. There are good points in it, however, considered as a guide-book; it is based on first-hand observations made on foot; it appears to be accurate, contains a useful map, and is mercifully free from fantastic theories. It may therefore do good, if it reaches the public for which it is intended. May we offer the author a suggestion, which we think might bear fruit? It is contained in a single word—folklore.

ASIA

The Sea Gypsies of Malaya.— **W. G. White.** With a foreword by R. R. Marett, D.Sc. London: Seeley, Service & Co. 1922. Pp. 318. *Illustrations and map.* 21*s. net.*

The Mawken and Selungs are a small race of obscure affinities which inhabits the Mergui Archipelago off the coast of Lower Burma. They number probably about 5000, and there seems to be little indication that they are dying out. In the main they are nomadic fishermen practising a little agriculture in places. They seldom come near the mainland unless to trade at Mergui or Victoria Point. They are expert divers and of old used to do a considerable trade in pearl oysters and pearls with Chinese and Burmese traders, but the shell in shallow water is cleared out and Japanese and Filipinos, using diving-suits, now monopolize the "fisheries." Green snail and trochus shells still interest the Selung, and there is also some trade in sea-slugs and edible birds'

nests. Fish and rice, obtained by barter, are the chief articles of food. Fruit, and wild honey from the jungle and a small amount of game on the larger islands, supply the rest. The Selungs are timid, inoffensive people who suffer to some extent from raiding Malays, but in the main hold their own in a home for which there is little competition. Several writers in the past have noted these curious people, but no one has made a closer acquaintance with them than Mr. White. He learned their language and lived among them for some time. Their origin is doubtful and Mr. White can throw no light on the problem. By their own account they began to spread through the archipelago from the north, and Malays forced them to scatter southwards. This, if true, would seem to contradict the opinion that the Selungs are Malays. As regards their language, Mr. White believes that any affinities with Malay can be shown to be modern adoptions. Their cephalic index suggests relationship with the Nicobar Islanders and not with the Malays.

Mr. White's book is of great value and should command wide interest. We could wish he had found space to deal with environment as well as peoples, which would have made his study more complete. By way of conclusion Mr. White gives a few ideas about the future of these fascinating people. Unless they are helped to develop on their own lines the Selungs in time will be assimilated by Chinese and Burmese in the north and by Malays in the south, and by Siamese in the Renong district. These tendencies Mr. White views with regret. He would like to see the Selungs encouraged and taught to develop the resources of the archipelago and saved from drifting to the mainland. In rubber and coconut growing he foresees a bright future for them. Bananas and pineapples do well on the islands, and the fisheries might be developed. This is an alluring prospect, but if the pearl oyster banks were restocked, as would not be impossible, it is likely that they would attract a mixed population of adventurers who would have the worst possible influence on this primitive race. Perhaps Mr. White realizes this, and so says nothing about the possibilities of improving the pearl and shell fisheries. R. N. R. B.

AFRICA

On the Edge of the Primeval Forest: Experiences and Observations of a Doctor in Equatorial Africa.— Prof. Albert Schweitzer. Dr. Theo., Dr. Med., Dr. Phil. Translated by Ch. Th. Campion. London: A. & C. Black. 1922. Pp. vi. and 180. *Illustrations and Sketch-map. Price* 6*s*.

Few books published of recent years dealing with the problem of blacks and whites in tropical Africa equal in importance this modest volume by Prof. Albert Schweitzer. The author (an Alsatian), well known as a theologian, philosopher, and musician, felt the call to succour suffering African humanity, and studied medicine in order to qualify himself for that task. Early in 1913 he took his M.D. degree and shortly afterwards, accompanied by his wife, who had trained as a nurse, went out to the Gabun and established a hospital on the banks of the Ogowe river, "on the edge of the primeval forest."

This book tells the story of his first four and a half years' labour. As a guide to the diseases of the tropics and their treatment it appears, to the lay reviewer, to be invaluable, and this opinion, it is known, is shared by the medical profession. But Prof. Schweitzer's book is more than that, as might be expected from an author who adds to the highest intellectual gifts a great heart, full of sympathy and understanding alike for the "untutored savage" and the exiled and often disillusioned white planter. The most valuable part of this doctor's observations is—so it seems to us—his diagnosis of the character of the Negro. He goes to the heart of the question of the Negro's development,

mind and body. The chapter on "The Mission" deserves the most careful study by all interested in the future of the Negro "within whom slumbers an ethical rationalist." No one well acquainted with the facts is likely to quarrel with the author's conclusions, or to confound the "unfavourable phenomena of intellectual emancipation" often exhibited by Mission boys with the real liberation of mind and spirit which follows genuine conversion.

Medicine and religion apart, this little volume contains telling descriptions of the country, racy narratives of travel, and a graphic account of the timber industry of the Ogowe, which, as Prof. Schweitzer depicts it (he confesses himself to be "a timber fanatic"), appears to be a far more hazardous occupation than mining. There are also moving passages upon the effects, moral and material, of the war in this far-away region. F. R. C.

L'Angleterre, l'Isthme de Suez, et l'Égypt au XVIII^e^ siècle.— François Charles-Roux. Paris: Plon-Nourrit et Cie. 1922.

This is a detailed and interesting study of the train of events which awakened Great Britain to a sense of the strategic importance of Egypt. As the author truly says in his preface, the English have shown little curiosity about the beginnings of their relations with Egypt and their political and economic interests in that country. The story which he has put together from the French and English State Papers thus fills a real gap in our knowledge of British expansion. It is in many ways a characteristic story. We see here, as so often in the history of the British Empire, the imagination and activity of individuals outstripping the cautious views and leisurely steps of Government; the enterprising traveller or merchant, who thinks he is seizing a great chance for his country, disappointed by economical politicians and baffled by vested interests. And we see, and of the eighteenth century one might almost say of course, France and England in competition, forcing one another on, from trade rivalry to political intervention, from political intervention to military occupation, and the mistress of the seas getting the upper hand in the end. The author sums up all this eighteenth-century history in his concluding paragraph: "In the rivalries of two nations it often happens that what one does turns to the profit of the other. So it fell out with England and France in Egypt. The persevering efforts of certain Englishmen, and for a time of the British Government itself, to communicate or trade with India by way of Suez, contributed to give France the idea of an expedition to Egypt, which took effect in the special circumstances of 1798. The French expedition to Egypt awoke and created the interest of England in that country.

Before the efforts to which he alludes the English had concerned themselves very little with the affairs of Egypt. In the seventeenth century they were occasionally represented by a consul, but his appointment appears to have been left to the Levant Company, and after 1756 for thirty years no appointment was made. On the other hand the French Government, from the time of Louis XIV. and earlier, took a continuous and considerable interest in Egypt, and Louis XIV. had also tried to open the trade route from Europe to India by way of Suez, but the Sultan had refused to allow Christians to navigate the northern part of the Red Sea.

Late in the eighteenth century James Bruce, the English traveller, persuaded the Bey of Egypt to grant the English the permission the Sultan had previously refused the French. That concession, though not at first desired or valued by the British Government, was to stimulate the Anglo-French rivalry, to hasten the course of events, and in the end to lead to the French expedition of 1798.

We cannot follow the author in detail through his account of the oscillations of British policy and the steady development of French. Suffice it to say that the story is well told and deals with an episode of no small importance in the history of British foreign policy. E. A. B.

The National Resources of South Africa.— R. A. Lehfeldt, D.Sc. Johannesburg: Witwatersrand University Press; London: Longmans. 1922. Pp. 79. *Price* 5*s*.

In a brief commendatory preface to this little book General Smuts describes it as the first effort of its kind, *i.e.* a survey of economic conditions in South Africa. Dr. Lehfeldt, the author, is Professor of Economics in the newly established University of the Witwatersrand, and his book is probably the first issued by that University. It is an excellent piece of work; the author's aim, in his own words, being to discuss "the chief points in which production and distribution [in South Africa] vary from the standards of other countries"—the variation being almost entirely due to the presence together of two races, white and black, at different levels of civilization. This is not the place to enter into a discussion on economics. Besides, however, commending Dr. Lehfeldt's book to careful study by those specially interested in South Africa, it is of general interest to point out that it is fully demonstrated that the mining industry in South Africa is not, and never has been, of equal importance to the country as farming. Moreover, Dr. Lehfeldt holds that the discovery of the gold and diamond mines, in hurrying on development, has not necessarily been an advantage to the country; in any case "South Africa is passing away from a prevailingly mining stage of development." These are home truths from a man who holds a professorial chair in the city of Johannesburg.

F. R. C.

A Handbook of the Sherbro Language.— The Rev. A. T. Sumner, B.A. London: Crown Agents (for the Government of Sierra Leone). 1921.

This book is made up of Phonetics and Grammar (78 pp.), Texts (18 pp.), and Vocabulary (36 pp.). The author is not quite happy in his phonetics—"head" is, for example, given as an illustration of a long vowel; and a diphthong is incorrectly defined as "two dissimilar sounds uttered without a break"; most remarkable of all, an "expletive" is said to be "a monosyllabic expression affixed to a word for the sake of euphony." Phonetics knows assimilation and dissimilation; but what is euphony and how does it act? Are there euphonic changes in European tongues? Another feature of the transcription that might be criticized is that the plural prefix written *te* with an aspirated *t* by three previous observers is recorded as a *th* sound.

In the grammatical portion the author is in error in laying down that the prefix in the Coast group of languages is used to indicate the definite and indefinite forms of nouns; in Temne there are prefix changes—an added *n* or vowel change—in some nouns that effect this distinction; but they are distinct from the class prefixes; in Sherbro the definite form is indicated by a suffixed *le*. As regards the affinities of Sherbro Mr. Sumner is of opinion that Krim (or Kirim) is simply a dialect of it; but the words for one, two, and five are different, as well as many ordinary words: *e.g.* eye, S. *hol*, K. *taun*; night, S. *col*, K *kule*; water, S. *nkon*, K. *masen*.

The proof-reading has been somewhat careless; on p. 78 Parrot appears for Poro, and on p. 12 the meaning of three words is omitted. The work is a useful first attempt and an improvement on Nylander's 1814 grammar; but much remains to be done. N. W. T.

AMERICA

The Conquest of Mexico.— W. H. Prescott, illustrated by **Keith Henderson,** with Introduction by **T. A. Joyce.** 2 vols. London: Chatto. 1922. 42*s. net.*

Just as a good wine needs no bush so the works of Prescott, most eloquent and graceful of historians, need no advertisement. The interest and imagination of the reader are aroused and maintained from beginning to end by the style and charm of the narrative. But Prescott's 'Conquest of Mexico' has always had a special interest for the anthropologist on account of his study and description of the Aztec civilization. This he dealt with in his first book and an appendix. It is to this aspect of the work that Mr. Joyce devotes a short introduction. It is very remarkable and a high tribute to Prescott's genius that he was able at the time he wrote, when anthropological science can hardly be said to have existed, to present the subject with so few mistakes and erroneous inferences, judging by the light of eighty years of archæological and anthropological research.

But the *raison de être* of this new edition of the 'Conquest of Mexico' is not the text, but the remarkable series of illustrations from the pencil of Mr. Keith Henderson. These open up a new era in historical illustration. In approximating text and illustration they are a veritable *tour de force*. The first book dealing with the ancient Aztec civilization is illustrated by drawings copied solely from native pictures. These most effectually attune the reader's mind to the text, and supply a sympathetic atmosphere in which his imagination can revel unperturbed by criticism. In illustrating the narrative of the Conquest, while maintaining this atmosphere, the artist gives his imagination full play, thereby producing a series of pictures as striking as they are bold and original. Both Mexican and Spaniard stand out before us with a realism that is often startling, and vividly call up the extraordinary scenes that attended this unique adventure. E. A. P.

A Geological Reconnaissance of the Dominican Republic.— T. W. Vaughan and Others. Official Publn. of the Secretaryship of State of Fomento and Communications, Dominican Republic. Washington. 1921. *Maps and Illustrations.*

At the present time important researches are being carried out on the geology of the countries bordering on the Gulf of Mexico and the islands that rise above its surface. We are taking our share in the task. Mr. Earle is at work on the Windward and Leeward Islands, Dr. Matley in Jamaica, and Mr. Ower in British Honduras. Trinidad and Barbados have recently been studied by numerous geologists employed by oil companies, but unfortunately the results have in many cases not been made public property. In British Guiana excellent work has been done by Sir John Harrison and his assistant Mr. Winter, but most of the country still remains unknown from the scientific standpoint. Elsewhere the work has mainly fallen into the competent hands of American geologists, and it is a matter of congratulation that the Geological Survey of the Dominican Republic has been undertaken by the personnel of the United States Geological Survey.

In the north of South America and in the West Indies the older structural directions run east and west. The principal zone of disturbance in the north of the Gulf of Mexico commences to the east in the Virgin Islands, traverses Costa Rica, but in Dominica it is seen to consist of two branches, one of which passes through Cuba into Southern Mexico and the other is continued into Jamaica. There is some evidence of its existence even in British Honduras.

The oldest rocks are grouped together under the title of the Basal Complex

This includes rocks as late as the Cretaceous, but probably many that are far older. It is believed that the main tectonic lines were in existence even in late Palæozoic times, though the area has been the scene of many subsequent movements. The Tertiary period was characterized by numerous deposits of calcareous and volcanic rocks, the succession of which has been to a large extent worked out on fossil evidence. The Quaternary is characterized by limestone of Pleistocene age. Its deposition appears to have been followed by an emergence of the land resulting in wave-cut shorelines and deep valley notches. A later depression converted these last into estuaries, some of which have provided harbours for commerce. It was succeeded by another elevation of smaller amount, to which shell and coral terraces bear witness.

In the Basal Complex both folding and faulting have been intense. Elsewhere faulting is the dominant element of the structure. The Tertiary and Quaternary palæontology is described at some length. Terrestrial mammals of South American types appear to have survived to human times, for their remains are found in kitchen middens. About sixty pages are devoted to the geology of different areas, and twenty-seven to economic geology. There are three maps on a scale of one in two million: one topographical, one geological, and the third showing the concessions which have been granted. J. W. E.

AUSTRALASIA AND PACIFIC ISLANDS.

The Discovery of Australia.— **G. Arnold Wood.** London: Macmillan & Co., Ltd. 1922. *Maps and Illustrations.* 25*s. net.*

There were great men before Agamemnon: and there have been many previous works on the theme now treated by Professor Wood. But some of them are out of print (and also out of date), and the remainder consist chiefly of monographs devoted to special chapters of Australian history. The want has often been felt, in recent years, of some work which should give a comprehensive survey of the whole subject and embody the results of those recent researches which we owe to the widespread energy and enterprise of the many Australian scholars and geographers who have made it their pride and duty to investigate the early history of their country. Amongst these Professor Wood takes a prominent place, and his book provides, in no stinted measure, a *résumé* of both bygone and recent investigations. Originating in a series of lectures delivered in Sydney University during 1917, it covers the whole history of the gradual unveiling of the shores of the Australian continent, from the earliest speculations of the Greek geographers to the time when the final filling-in of the last outlines was performed by Flinders. Carefully documented, well arranged, and profusely illustrated (although one could wish that the reproductions of the various maps had been on a somewhat larger scale), it constitutes an admirable text-book of a fascinating subject.

Professor Wood is obviously not one of those authors who consider that unless a book be kept as dry as the Sahara it stands in great danger of not being taken seriously. Witness the following enumeration of Dampier's defects considered from the standpoint of his early calling:

"... The 'trade' (piracy) he regarded as lawful, but uninteresting. But he came into those seas the second time, he says in plain and honest language, 'more to indulge in my curiosity than to get wealth.' One feels, in fact, that Dampier was hardly treating his friends fairly, and they also felt this. Piracy is a serious trade, and a man who undertakes it should undertake it in a piratical spirit. A man who has no particular objection to the ten commandments, and cannot even raise a thirst when in the Tropics, has no right to be a pirate. Dampier was making use of an honourable trade to serve his own personal

convenience. When he should have been thinking about murder and loot, he was thinking about crocodiles and beetles. No wonder his exasperated companions talked of eating him. And, looking at his portrait and remembering his habits, no wonder they didn't."

Of all the great figures in the story of Australian exploration, Professor Wood gives similar intimate and personal character-studies. Not all of them, probably, will be found acceptable to hero-worshippers. Towards Tasman he shows himself extraordinarily harsh, and the description of Drake as "Eternal English Boy" might move the shade of Sir Francis to inquire why his virtues should be signalled to posterity by this peculiar conjunction of epithets. But when writing of the majority of the great navigators—Dampier, Cook, Flinders, La Pérouse, and especially Quiros—Professor Wood displays extraordinary sympathy with, and insight into, their characters, obviously based upon prolongéd study of their lives and their times.

One of the perennially interesting questions in connection with the history of Australia is that of its alleged discovery in the sixteenth century, as recorded in the "Dauphin" and similar maps, and to this point a chapter is devoted. Curiously enough, the author does not refer to an examination of this point, in some detail, which appeared in the *Geographical Journal* for October 1899. The conclusion reached therein, which is also Professor Wood's, is that the vast expanse of territory shown on those maps as occupying all, and more than, the space filled by Australia and New Zealand, was in reality a well-meant effort on the part of some Portuguese cartographer to represent Marco Polo's "Java Major." Professor Wood deals very faithfully with the evidence available on both sides of the question—too faithfully, perhaps, for the peace of mind of some of the weaker brethren among geographers, for his synoptic chart emphasizes the resemblance between the land of the Dauphin maps and the outlines of Australia and New Zealand in a manner which may well make the most hardened disbeliever in the authenticity of the former somewhat thoughtful. But the studied fairness of his presentation of the "Major" point of view lends added weight, if any were needed, to his own conclusion—that there is no real ground for supposing that any vessel sighted any part of the coast of Australia before the voyage of the *Duyfken* in 1605.

Of this voyage, and of the others performed by the early Dutch explorers who, between the years 1605 and 1644, "brought three sides of Australia into accurate existence on the map," Professor Wood writes fully and graphically, but he inveighs strongly, and, one would like to think, a trifle too harshly, against the sordid motives which inspired them. It is undoubtedly true, as he remarks, that ". . . the thought about the salvation of" numberless multitudes of blind heathen "sounds strangely in the mouth of a Commercial Company whose representative in Japan was complaining that profits were being diminished by the false and scandalous accusation that the Dutch were interested in the progress of Christianity"; and again that ". . . the men who went to Java to trade, and to sail, and to govern seem generally to have been drawn from the poorest and least-educated class." But it is scarcely fair to infer, from these premises, that none of the Dutch navigators possessed any spark of enthusiasm for discovery. True, it may have been damped by the commercial views of their masters, but no sailor, however poor and unlettered, could, one thinks, when in sight of an unknown continent, so resolutely shut his eyes to facts as to remain unmoved by the inspiration which such a circumstance inspires.

A minor point of interest in this chapter is an extract from Pelsart's journal, which goes to show that the first kangaroo seen by Europeans was that noted

by the crew of the *Batavia* in 1629, and not, as is generally stated, the one seen by Banks at Cooktown in 1770.

It is impossible, within the limits of a review, to give more than a fragmentary sketch of the contents of a very able, accurate, and readable work. All who take an interest in the subject of Australian exploration will find it, both in gross and in detail, a remarkably sound and well-balanced presentation of facts and opinions. Its value as a work of reference is enhanced by the citation, at the head of each chapter, of the principal authorities consulted; by an excellent track-chart, showing the routes in Australian waters of all explorers from Magellan (1521) to Grant (1800); and by a very complete index.

R. T. G.

Midst Volcanic Fires.— Maurice Frater. London: James Clarke & Co., Ltd. N.D. [1922]. Pp. 288. *Eight Illustrations from Photographs.* 6*s. net.*

The first and the last chapters of this book will possibly attract a wider circle of readers than the intervening nine. The former relates in lurid and thrilling language the tremendous eruption of the volcanoes of Ambrim island that occurred in December 1913, and of which the author was a close eye-witness. The final chapter deals with "The humorous side of mission work," and is full of quaint situations and comical incidents which are none the less humorous because they are innocent. Many acts of heroism were performed during the rescue of about 3000 natives from the advancing lava-streams of six craters, and in removing the fugitives some 15 or 20 miles to neighbouring islands in motor boats. The mission hospital on the sea front was shattered, burnt, swallowed up, and finally submerged 12 fathoms deep in a newly formed crater lagoon, not a splinter of the building being left; while a range of hills 500 feet in height dammed up what had been a valley behind its former site. The remarkable photograph that supplies a frontispiece to the volume shows the officers of H.M.S. *Sealark* standing on the very edge of the abyss of one of the largest craters several months after the main eruption, a column of dense smoke rising to a measured height of 12,000 feet close in front of them.

The book is well written, and the author, a Scottish Presbyterian missionary, displays, with one or two exceptions, a refreshing breadth of mind and general culture not always observable in the itinerant evangelist. He is unduly confident, perhaps, in decrying the employment of *kava* by the natives, the prohibition of which by the Wesleyan Methodists in Fiji proved an entire failure, as did also their *tabu* against tobacco, a more deleterious plant. But Mr. Frater does not obtrude his views on the reader; and the body of the volume, which is of a definitely "missionary" cast, is so chattily expressed and so pleasantly leavened with incident that what the casual reader might call its "sanctimonious flavour" does not pall, but it repays reading right through. Like almost every book published by a missionary, the volume has no index. A sketch-map of Ambrim showing the recent changes of surface, with an inset of the New Hebrides as a whole, would have served to elucidate some parts of the text.

B. G. C.

POLAR REGIONS

From the Deep of the Sea, being the Diary of the late C. E. Smith, Surgeon of the Whale Ship "Diana" of Hull.— Edited by C. E. Smith Harris, M.B., Ch.B. London: A. & C. Black. 1922. Pp. 288. *Maps and Illustrations.* 10*s.* 6*d. net.*

The "right" whaling in Baffin Bay was at its height in the middle of last century. Every year saw the wooden ships of Dundee, Peterhead, and Hull

make for Davis Strait in June, often after a short season hunting seals along the pack edge between Jan Mayen and Greenland. Since about 1820 the whalers had made a practice of going well north instead of following the older habit of hunting around Disco. The course was northward along the coast of Greenland, across the dreaded Melville Bay to the "North water" of Baffin Bay and the "fishing" grounds of the "West water" around Lancaster Sound, Eclipse Sound, and Pond's Bay. The whales left the Greenland coast in June and crossed by the "Middle ice" to the coastal waters of Baffin Land. Till August the whales continued "running" there and then began to move south, the whalers following them as long as ice and weather permitted, but every whaling skipper hoped for a full ship by August. This enabled him to return home with a minimum of risk from pack ice. In 1866 the *Diana* followed this route. It was an exceptionally bad ice year. Melville Bay was as dangerous as usual and the "North water" was badly congested. The whaling was largely a failure, and by early August the fleet was leaving the "country" for home. The *Diana*, with low-powered engines, could not force a way through the pack. Attempts to find open water on the east of Baffin Bay were equally hopeless, and Captain Gravill had to accept the grim alternative of allowing his vessel to become beset and drift with the pack southward along the shores of Baffin Land. It was a hazardous journey. Many times the ice threatened to crush the ship. In Frobisher Inlet, in which the *Diana* was drifting for three months, the crew, believing that the end had come, abandoned their ship for a time. For seven months the *Diana* was in hourly peril, and the crew had to sustain life on two months' stores. Everything except a little biscuit and meat was lacking; there was practically no fuel; scurvy attacked most men, and the captain died during the winter. Eventually, in about lat. 69° N., the *Diana* escaped, and the remnant of the sore-stricken crew brought her back to Lerwick. Of the ship's company of fifty-one, the deaths numbered thirteen, and, curiously enough, the percentage of deaths among the Shetland harpooners was much higher than among the English crew.

Mr. Smith Harris has been well advised to publish his father's diary. No doubt there were many such unrecorded adventures among whalers, but few ships had the good fortune to have on board so graphic a writer as Mr. Smith. The book provides not only a thrilling story of adventure but adds a missing chapter to the records of Arctic travel. For those were the days when the cause of scurvy was unknown and Arctic travellers never dreamed of eating seal-meat and sea birds if anything else, even the most meagre fare, was available. Incidentally, the book contains much interesting whaling information.

R. N. R. B.

GENERAL

Travel Old and New. A Selection from the Literature of Travel in Both Hemispheres.— Edited, with a Foreword, by **S. J. Looker.** London: D. O'Connor. 1922. Pp. xxx. and 472. *21s. net.*

This is an anthology designed to interest the general reader. The compiler has shown a catholic choice in his selection and has confined his attention almost entirely to prose extracts. In the section of "The Great Adventurers" we look for Scott and Shackleton, and are surprised to find them represented not by their own words but by quotations from magazine articles on their expeditions. The book will no doubt find a welcome among those to whom anthologies appeal. The end papers illustrate the *Sovereign of the Seas*, built in 1637, taken from an old print.

THE MONTHLY RECORD

THE SOCIETY

Medals and Awards, 1923.

HIS MAJESTY the King has approved the award of the Royal Medals as follows: The *Founder's Medal* to Mr. Knud Rasmussen, for his exploration and research in the Arctic regions during the last twenty-five years; the *Patron's Medal* to the Hon. Miles Staniforth Cater Smith, for his explorations in the unknown interior of Papua. The Council have awarded the *Murchison Grant* to Captain A. G. Stigand, for his map of Ngamiland; the *Back Grant* to Mr. B. Glanvill Corney, for his studies in the historical geography of the Pacific; the *Cuthbert Peek Grant* to Messrs. R. A. Frazer and N. E. Odell, to assist them in continuing their explorations of Spitsbergen; and the *Gill Memorial* to Captain Augiéras, for his journey in 1920-1921 from Algiers to Mauritania.

Honour for Sir Aurel Stein.

The Swedish Anthropological and Geographical Society has conferred the Anders Retzius Medal in gold upon Sir Aurel Stein for his archæological research in Central Asia. Since its institution in 1910 only two previous awards have been made: in 1910 to Professor Montelius, and in 1921 to Sir Arthur Evans, for his work in Crete.

The Medal was delivered to His Majesty's Minister at Stockholm by H.R.H. the Crown Prince of Sweden, on the occasion of the fiftieth Anniversary of the Society. In handing it to Sir Colville Barclay the Crown Prince asked him to convey to Sir Aurel Stein his personal congratulations on invaluable work in a field of research in which his Royal Highness takes a lively interest.

The Medal has been transmitted through the Foreign Office to this Society for conveyance to Sir Aurel Stein on his return to England.

Retirement of Mr. H. W. Simpson.

With the retirement on a pension at the end of March of Mr. H. W. Simpson, senior clerk in the Society's office, one of the last survivors of the staff as it was in the old days of Mr. Bates' secretaryship disappears from the Society's house, though we hope he will live long to enjoy the leisure earned by a service of over forty years. We are sure that he will carry away the esteem and good wishes not only of the colleagues who have worked with him so long, but of the Fellows at large, to many of whom he has been a familiar figure at the Society's house, and (as lanternist) at its meetings, during the whole period of their membership.

EUROPE

MS. Maps of General Wade's Roads.

A remarkable collection of Scottish plans and MS. maps has lately been secured by the Royal Scottish Geographical Society, and is described in the *Scotsman* of February 24 by Mr. H. G. Inglis, a well-known authority on early Scottish cartography. The importance of the maps consists in their evident connection with the career of General Wade in Scotland, all relating to just the part of Scotland with which he was specially concerned as Governor of Fort William, Fort Augustus, and Fort St. George, and the maker of the roads leading to them. Of seventy-six routes described in John Moncur's pamphlet of 1711, only three were in the Highlands, and Wade's task was to connect up the isolated posts by good roads. The earliest dated map in the collection (1724-5) is dedicated to him. Another of the earlier maps, evidently made between

1720 and 1730, seems to be a sketch by some officer in the Fort William garrison, indicating the routes to be followed to reach Stirling and Inverary. It shows that the old bridle road to Fort William lay through Glencoe, and that Wade's road by the "Devil's Staircase" was an entirely new road made to avoid the ferry at Callert. Another map, probably made about 1735–40, seems to be a military surveyor's report upon the state of the Stirling–Fort William road, and states that the road to "Kilmehug," near Callander, "is already carte road"—which the rest evidently is not. It indicates the chief improvements needed at various points, and gives much interesting information in notes at the foot. A finely drawn map of the Inverness district is said to be the most detailed and accurate early survey of that part of the country ever made. From the similarity of style with another map signed J. Avery, 1735, there seems little doubt that it is his work. There is a general map of Scotland apparently used for pencilling in Wade's roads, and for showing the position of every clan in the Highlands, and the number of men each can muster. The signed map of Avery's is the plan of a road from Kingussie to Braemar, which we can therefore now consider to have been talked of for 197 years! The scale is 1 inch to the mile, and the span of every bridge to be built on the route is named. Besides plans of Fort William, there are seven relating to the intended fortress at "Killywhymen," ranging from 1724–5 to 1729. Altogether there are in this one volume plans of the three forts of which Wade was Governor besides reports on the state of the roads to Fort William, so that the collection may be taken as forming a connected unit.

The engraved plates in the volume are mostly well-known plans of Edinburgh, but there is also a fine engraving of the Netherbow, dated 1746, which does not seem to have been known hitherto.

The Warm Climate of Upper Alsace.

The exceptional character of the climate of the tract in Upper Alsace lying along the eastern foot of the Vosges is well brought out in a study by Prof. A. Knörzer, issued as Part iii. of vol. 22 of the *Forschungen zur deutschen Landes- und Volkskunde* (Stuttgart: J. Engelhorns Nachf., 1922). By a careful analysis of the meteorological records available for Colmar, in which town the typical conditions of this "Warmeinsel" find their fullest expression, the writer shows what decided advantages as regards warmth this district possesses over practically the whole of Europe north of the Alps, whilst in many respects it bears fair comparison with more southern stations such as Lyon or Lugano. The complete set of tables supplied by Prof. Knörzer afford the basis of comparison with a number of other places both month by month and for the year as a whole, and as regards both mean and absolute temperatures. Colmar is shown to have the advantage over Mulhouse and Strasbourg within the same section of the Rhine plain, as well as over most of the warmer districts of Germany such as the southern foot of the Taunus, the Rheingau, and the valleys of the Neckar and Moselle, for all months except, possibly, December and January. The summer maxima, though high, are not remarkably so, the high average being rather due to the long persistence of the warmth. An explanation of these exceptional conditions is to be found in the influence of the high wall formed by the Vosges in the west, and the dynamic heating of the föhn-winds which descend from them, particularly in the Colmar district. The Alpine föhn has some effect too. Comparable mean yearly temperatures are to be met with in Central Europe north of the Alps only in the lake and föhn region of northern Switzerland, and on the eastern border of the Alps, and no station in these areas quite equals Colmar, which has a special advantage

in spring. The shut-in character of the district promotes cooling by radiation, so that low night minima occur occasionally and the summer warmth is partly due to the same cause, but the daily and monthly range of temperature is not greater than in the rest of the Rhine plain. Relative dryness is likewise a characteristic of the region, the rainfall figures increasing in all directions from this centre. The warmth of the climate leaves its impress on the general character of the vegetation and also on the fauna. The vine grows as in more southern climes, and with the associated fruit trees (peaches, damsons, and plums) and irrigation channels, recalls the sunny plain of the Po. The wild flora too shows special features, and many species of animals here reach their most northern limit.

AFRICA

Colonel and Mrs. Statham's Journey across South Central Africa.

An interesting and adventurous journey across South Central Africa, in great part through little-traversed districts, has lately been completed by Col. J. C. B. Statham, C.M.G., C.B.E., and his wife, who were married only a short time before starting on the journey. Mrs. Statham is to be congratulated on the pluck and endurance which have brought her through the hardships inseparable from such a journey, in regions where for long distances no white woman and few white men had been before. Leaving England in March 1922, they landed at Mossamedes, whence, after a trip into the desert country of South Angola, the trans-continental journey was commenced. The first stages —to Lubango and thence to the Kunene river—were done partly by narrow-gauge railway, partly by road. The Kunene was crossed near the post of Capelongo, where a small two-wheeled wagon and four span of oxen were hired, and the journey was continued down the Kunene and up its tributary, the Chitanda, the party then striking across to the upper Okavango or Kubango. It was originally intended to journey down this in canoes from the point where it was struck near the Umbali junction, but neither canoes nor boatmen who would face the rapids were obtainable. After following the river down for about 100 miles a canoe was secured at Kaianda, and the journey by water commenced. It was continued for nearly 500 miles to Andara's (or Libebe), and entailed the passage of well over 100 rapids. The increasing danger of navigation then made it necessary to abandon all hope of continuing the voyage by the Okavango and the connecting channel of the Selinda or Magwedana to the Kwando and Zambezi, and to undertake instead a land journey across the northern Kalahari. Extreme and probably exceptional conditions of drought in their turn prevented a direct easterly route to the Kwando, and a more northerly one had to be taken across a practically waterless sand-belt, bringing the party to the Loengi river near its junction with the Katembwe. The little-known Loengi was then followed to its junction with the Kwando, and the latter to the border of the "Caprivi strip." The northern, arid, portion of this was then crossed to the Zambezi, which was descended in a canoe-barge to Katimboro above the Victoria Fails. An injury sustained by Colonel Statham while saving his dog from a wounded roan antelope made it impossible to continue the canoe voyage down the Zambezi as intended, and the rest of the journey was done by land through Portuguese East Africa, Nyasaland, and Rhodesia with a view to completing studies in those countries begun some years ago by Colonel Statham.

Surveys in the Gold Coast.

We have received the report of the Gold Coast Survey Department for 1921, which tells of the progress made during the first complete year since the

re-organization of the Department in 1920. The whole work was closed down during the war, and the bringing together of the requisite personnel involved some delay, whilst even after resumption of operations it took some time for the new staff to get used to a strange country and new duties. Thanks, however, to the energy of Major G. H. Bell, M.C., Director of the Topographical Branch, the survey was working rapidly and smoothly by the end of 1921 and producing very accurate and detailed maps. A general map which accompanies the report shows the area completely surveyed by December 1921 (3400 square miles) and the much larger area expected to be surveyed by June 1922, the two together making up approximately 11,000 square miles. It also shows the chains of triangulation completed, as well as the theodolite traverses and lines of levelling so far carried out. During 1921 the triangulation framework in the eastern province was extended and eventually carried to Lake Bosumtwe, whence a connection with Kumasi was made by traverse. At first the framework could not keep pace with the detail survey, but this difficulty will not be felt in future. The prevalence of dense forest renders the task of the surveyor peculiarly arduous, and often raises the cost to as much as £4 per square mile; but the provision of good maps showing the form-lines of the country is indispensable for the suitable alignment of roads and railways, and their want has often involved costly mistakes. The first proofs of the new Topographical Survey were received before the end of the year, and it was expected to publish the Standard Sheets on the scale of 1/125,000 at the approximate rate of two per month. Special branches of work included research on the behaviour of aneroids, especially when transferred rapidly for considerable distances by motor-cycle; and it is thought that improvements in the type of instrument may be possible to suit the conditions in West Africa. A committee on the spelling of place-names had begun the formation of an authorized list of spellings for the principal places. The report speaks of the methods adopted for the cadastral work, the projection chosen being that known as the "Transverse Mercator," or otherwise as the "Gauss Conformal." A four-minute grid for the "Colony co-ordinates" decided on had been computed up to 7° N. lat. In view of the rapid development of the colony a complete cadastral survey will be found an urgent necessity. For all kinds of survey work it is hoped to greatly extend the employment of natives in the future, and a survey school for their training has been established.

Photograph of Lake Chala: Erratum.

We are asked to state that the photograph of Lake Chala in the January number (p. 13) is not by the Hon. C. Dundas, but by Colonel G. P. Maxwell, R.E.

POLAR REGIONS

Canadian Stations in the Arctic.

The Annual Report for 1921–22 of the Royal Canadian Mounted Police gives details of the progress lately made towards the establishment of fixed administrative stations in the Arctic islands over which the Dominion exercises control. The previous report had described the establishment of the Police Detachment at Ponds Inlet, one of three posts which it was intended to establish, the plan being to place the other two on North Devon and Ellesmere islands respectively. In July 1922, the C.G.S. *Arctic*, Captain Bernier, sailed from Quebec with Inspector Wilson—a commissioned officer—and eight other ranks of the Police, the Department of the Interior being represented by Mr. J. D. Craig. She carried building materials and stores for two of the posts, those for the North Devon post being left to be taken north in 1923. The entrance to Ponds Inlet was reached on 15 August, but, pack-ice making it impossible to enter, the

Arctic proceeded to Jones Sound. Ice likewise blocked Fram Fiord, on the south coast of Ellesmere Island, which had been chosen as the site of the post; but a fairly suitable place was found on the shore opposite Smith Island, and here Inspector Smith decided to winter, the landing of stores being completed after hard work on August 28. The spot has been named Craig Harbour, and here the Inspector remains with one non-commissioned officer and five constables. A post-office has been established, but it can hardly be expected to function for any large part of the year. As the headquarters of the three northern detachments it is thought that Dundas Harbour on the south coast of North Devon offers the best advantages, Lancaster Sound being usually clear of ice for a longer time than Jones Sound. The stores, etc., for Ponds Inlet were landed on the return voyage early in September, access to the post being still much hampered by ice. From the west of Arctic Canada it is reported that the headquarters of the "Arctic" Sub-District are being removed from Herschel Island to Aklavik in the Mackenzie delta, which has of late become the trading centre of the district. Fort Macpherson is being abandoned, while the Tree River detachment is being strengthened and a new detachment will be established at Cambridge Bay, on the south coast of Victoria Island, about 200 miles from Tree River, itself a very remote post. The report states that in April 1922 a patrol visited Mr. Knud Rasmussen's camp on an island near Melville peninsula.

MATHEMATICAL AND PHYSICAL GEOGRAPHY

Ice in the Greenland Sea and North Atlantic Weather.

An instructive study by W. Wiese in the *Annalen der Hydrographie und Maritimen Meteorologie* (1922, No. 10) brings out a decided connection between the amount of ice carried by the East Greenland current between lats. 66° and 71°, as indicated by charts of the Danish Meteorological Institute, and the distribution of wind and pressure in the North Atlantic and North-Western Europe. It is shown that in heavy ice years there is an intensification and expansion of the glacial anticyclone of Greenland at certain seasons of the year, causing the North Atlantic cyclones to keep a more southern track than in light ice years, with effects on the rainfall and temperature of Northern Europe. Some interesting correlations are brought out. Thus at Douglas, in the Isle of Man, the variability of air temperature in April and May is shown to be markedly greater in the heavy ice years; the increased frequency with which draughts of clear polar air descend upon the British Isles being favourable to greater vicissitudes of temperature at this season than occur with the more cloudy weather and south-westerly winds in the light ice years. At Douglas frost has been recorded in May in six years out of thirty-two, each of the six being years with more than the average amount of ice in the Greenland Sea. Again, the mean temperature in October at various places in Scotland is found to be 0·65° C. below the normal in years of abundant ice-drift, and 0·8° C. above in years of little ice. Taking the region to the north of the mouths of the great Siberian rivers as the focus of polar ice production, and as the source of the drift ice in the East Greenland current, and taking four and a half years as the average duration of the drift towards that portion of the Greenland Sea between 66° and 71°, the author shows that a high degree of correlation, amounting to $-0{\cdot}83$ with a probable error $\pm 0{\cdot}05$, actually exists between the temperature of the air at Obdorsk and Turukhansk in Arctic Siberia during the months of September, October, and November, and the ice area of the Greenland Sea between April and July four and a half years later. Thus a cold autumn in northern Siberia indicates with great probability abundant ice in the Green-

land Sea in spring and summer four and a half years later, and conversely a mild autumn signifies that there will be relatively little ice. It is of course known that the glacial anticyclones of Greenland and Antarctic play an important part in returning to lower latitudes air that rises in the tropics, and the above paper should be regarded as indicating one factor which to some extent tends to modify the general process from year to year.

Relation of Sea-water to Ground-water along Coasts.

The question of the contamination by sea-water of fresh-water supplies derived from wells in the vicinity of coasts is of much practical importance, especially in thickly peopled regions or small islands where no part is at any great distance from the sea. The results of a careful investigation of the New Haven area, Connecticut, in this connection are given by Mr. J. S. Brown in the *American Journal of Science* for October 1922. The inquiry included a study of the topography and geological formation, collection of records of wells, springs, etc., and analyses of many samples of water, chloride content being used as the chief criterion of the presence of sea-water, with due care to eliminate the possibility of its being otherwise derived. As a "drowned coast" the New Haven coast is very irregular, with much flat tidal marsh, sand spits, and bars. The bed-rocks are mainly gneiss and schist, often covered by glacial till or stratified drift. In the first the ground-water is held in open fractures, whilst in the porous drift there is a generally even water-table, and many of the shallow wells along the coast are sunk in this. It was found that here the zone of contamination by salt water was very narrow, nowhere more than 250 feet wide. Most of the deeper drilled wells penetrate bed-rock, and in these the danger of obtaining salt water increases rapidly with the depth of drilling, and also with the extent of fracturing; but as the underlying rocks become practically impervious within a few hundred feet of the surface the invasion by the sea-water terminates in Connecticut within a few hundred feet of the shore, whereas in places in Holland it has been proved to extend several miles inland. Good water may be obtained even in quite small islands where the soil is of a porous nature so that rain is easily absorbed, the lower specific gravity of the fresh water keeping it at the higher levels, and by the law of equilibrium the higher the level of the water-table above the sea the greater will be the depression of the underlying salt water. In New Haven harbour a layer of impervious mud produces artesian conditions and keeps out the salt water from the strata beneath. Excessive pumping may draw salt water landwards, and in some wells seasonal variations are observed, probably owing to variations in rainfall and temperature, a high temperature greatly increasing the rate of percolation.

Atmospheric Optical Phenomenon.

We regret that in our note in the January number, pp. 66, on an atmospheric phenomenon observed in the Persian Gulf, Dr. Bernhard-Smith's name (as it should have been given) was incorrectly printed. With reference to such optical phenomena, Mr. G. O. E. Knight writes to us from Darjeeling quoting a description given by him last year in the *Statesman of India* of an appearance of possibly somewhat analogous character observed by him at Gyangtse, Tibet. The appearance (seen for some two or three minutes after actual sunset) is described as "very similar to a series of rapid, dark greenish shafts of light, cone-shaped, with their apex lying in the direction of the vanished sun, appearing to shoot across the horizon from right to left, and as rapidly disappearing. The apparition lasts from three to five seconds, and is not to be confused with the familiar green flash at sunset."

GENERAL

Trade Routes between West and East in A.D. 700.

That it is possible to lay down with confidence the main line of communication between east and west through Central Asia in the early centuries of our era is largely due to the explorations and researches of Sir Aurel Stein (among others), and his monumental work 'Serindia,' reviewed last year in the *Journal*, is a storehouse of information for all who desire to go fully into the subject. As a concise yet illuminating summary of the conditions prevailing at the time when such early intercourse was at its height, a short paper by Dr. A. Hermann, who has long been a student of such matters, may be of use to those unable to consult larger works ('Die Verkehrswege zwischen China, Indien und Rom um 100 nach Chr. Geb.'; Leipzig, J. C. Hinrichs'sche Buchhandlung, 1922). At the time in question both the Roman and Chinese Empires were at the height of their power, and the Chinese conquests in Central Asia had enabled them to throw out long feelers towards the west and to control the land routes traversing the narrow band of country between the Gobi on the north and Tibet on the south. Between the two great empires the chief intervening powers were first (from the side of China) the Kushan, a Scythian people who then dominated the tract between the Oxus and the Ganges; and, as chief intermediaries with the Mediterranean lands, the Parthians between the Caspian and the Persian Gulf and the Arabs between that gulf and the Red Sea. The two main routes from China through the Tarim basin debouched eventually on Bactra south of the Oxus (the modern Balkh) and Purusapura (now Peshawur), from both of which Eastern wares found their way south to India. The further progress westward again followed two main routes, one through the north, the other through the south of the Parthian domain, converging in time on Seleucia on the Tigris. A third but less important route followed the course of the Oxus, then crossing the Caspian and serving the countries round the shores of the Black Sea. From Seleucia the goods either reached the great emporium of Antioch by way of Nisibis and Edessa, or, crossing the desert *viâ* Palmyra, found their way to Damascus and Tyre. A competitor with these land routes was the sea route through the Indian Ocean, which then had its starting-point at Catigara in the modern Tongking, and for the most part followed the coasts of Indo-China and India to Barygaza (now Baruch on the Gulf of Cambay) and Barbaricum at the mouth of the Indus. According to their destination goods then took the Persian Gulf route to Mesopotamia or that by the Red Sea to Egypt and its great emporium Alexandria, the rival of Antioch as a distributor of Eastern goods over the Mediterranean. These trade relations for the first time brought widely separated nations into contact with each other, Indians and still more the people of southern Arabia finding their way east to China and west to the Roman Empire, whilst traders from the latter reached China either by land or sea. The list of authorities given by Dr. Hermann is somewhat one-sided, and we miss not only the names of such writers as Yule and Cordier, but even that of Sir Aurel Stein, though his discoveries are briefly spoken of in the text.

Sale of Cook Documents.

High prices were realized, as was anticipated, in the sale at Sotheby's on March 21 of the Documents by or relating to Captain Cook, referred to in the March number of the *Journal*, p. 227. Most of the principal items were bought by the Australian Government for the Mitchell Library at Sydney, five thousand pounds being given for the original MS. of the diary kept by Cook during his first voyage in the *Endeavour*, 1768–71. Besides the interest arising

from Cook's autograph, it has an importance as differing in certain particulars from the three contemporary copies, on one of which Admiral Wharton's version, printed in 1893, was based. In particular it shows, by the corrections and alterations of the place-names, the various stages by which some of these reached the forms finally given to them. The next most important document, which sold for £720, was the autograph MS., of about 13 pp. large folio, describing the coasts of Nova Scotia, Newfoundland, Cape Breton, etc., written by Cook when master of H.M.S. *Northumberland*, Flagship of the North American Squadron, in 1758–62. It contains two maps drawn in water-colours and pen and ink, one being signed and dated 1762. Another lot, which fell to Messrs. Maggs for £390, is a MS. compilation of sailing directions and other memoranda relating to the passage to the East and West Indies, thought to have been written by Cook between 1755 and 1762.

New Work for Scott's Ship, the "Discovery."

Following the recommendations of an Inter-Departmental Committee of the Colonial Office, it has been decided to undertake researches in the southern waters surrounding the Dependencies of the Falkland Islands, particularly South Georgia and the South Shetlands. Their principal object will be to investigate the question of the preservation of whales and the whaling industry in those parts, and for this purpose Scott's old ship, the *Discovery*, has been purchased and will be refitted in readiness for a start next year. The researches will be controlled by an Executive Committee, on which this Society is represented by Mr. J. M. Wordie, of St. John's College, Cambridge, a member of Sir Ernest Shackleton's Antarctic expedition in the *Endurance*.

MEETINGS: ROYAL GEOGRAPHICAL SOCIETY: SESSION 1922–1923

Ninth Evening Meeting, 26 March 1923.—The President in the Chair.

ELECTIONS.—Albert Victor Band, B.A.; Rev. Thomas Harry Barnett; Gilbert Machell Bland; Capt. Joseph Oliver Cutteridge; Miss Florence Farmborough; Duncan Garrow; Capt. Thomas Henderson, M.C., A.F.C., R.A.F.; Norfor Evelyn Heseltine; Thomas W. Hodgkinson; Col. Gerald Frederick Towlerton Leather; Arthur John Martin; Capt. Robert John Harley-Mason, M.R.C.S., L.R.C.P.; Stanley Ruddock; Admiral Sir Edmund J. Warre Slade, K.C.I.E., K.C.V.O.; George Michael Slattery; Cuthbert James Smith, B.A.; Rev. Milton Theobald Stauffer; Rev. William Homes Tate; Commr. G. E. Warner, R.D., R.N.R.

Paper: The Waterways of the Sudd Region, Bahr el-Ghazal. Dr. Cuthbert Christy.

Tenth Evening Meeting, 9 April 1923.—The President in the Chair.

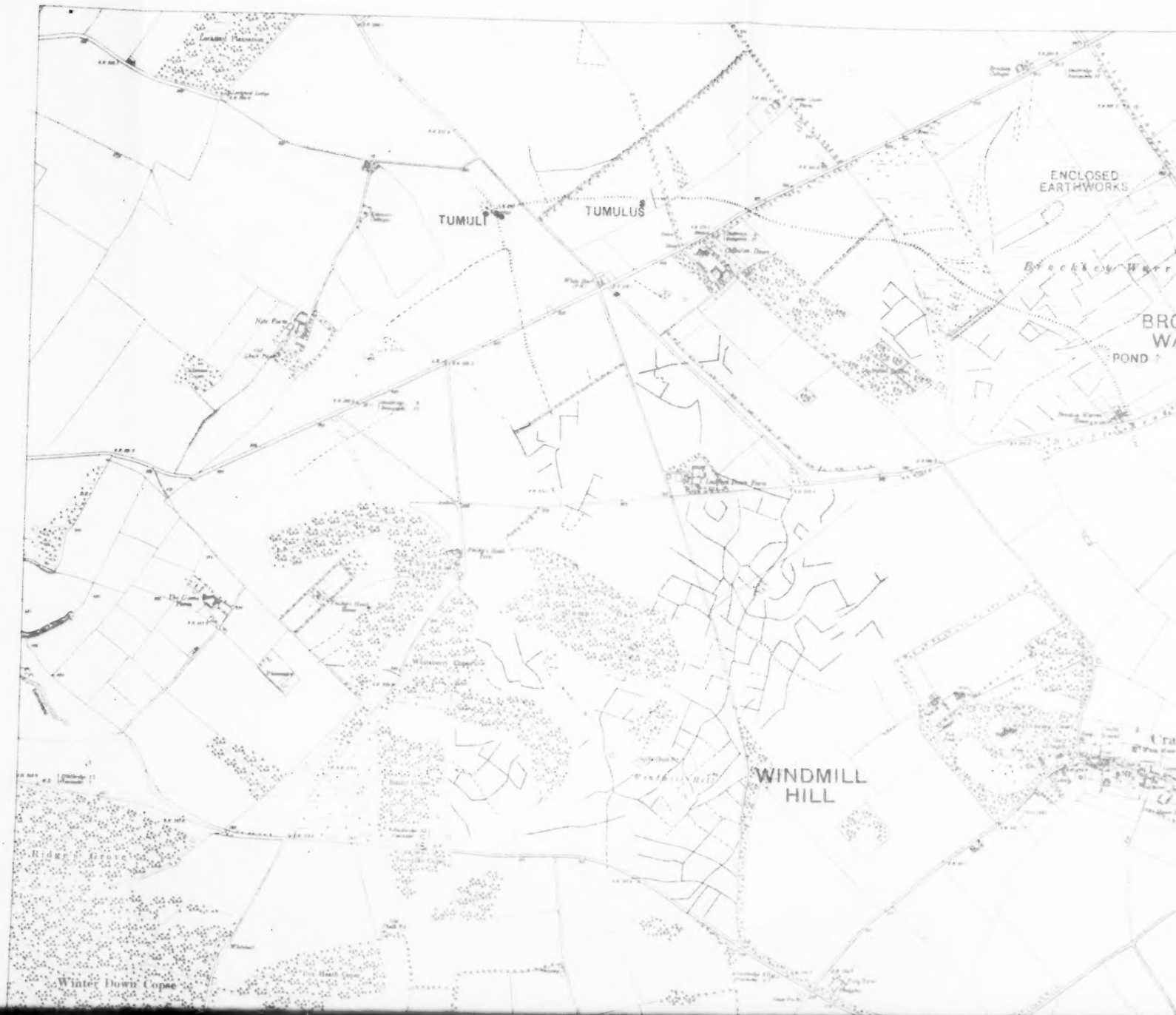
ELECTIONS.—Reginald Cory; Major William Cross; Capt. Thomas Edward Donne; W. Gleaves Doyle; Miss Emily Fletcher; Cyril Thomas Frederick Gibbs, B.A., LL.B.; Arthur Reginald Glendower Hart; Major Harold Hemming, A.F.C.; Frederick William Ratcliffe-Holmes; Capt. William A. T. Kidd; Henry L. Reynolds; Laurence Saunders; William James Stevenson; Mrs. Haig Thomas; Arch. H. Wheeler.

Paper: Geographical Influences bearing upon Japan and her Neighbours. Poultney Bigelow.

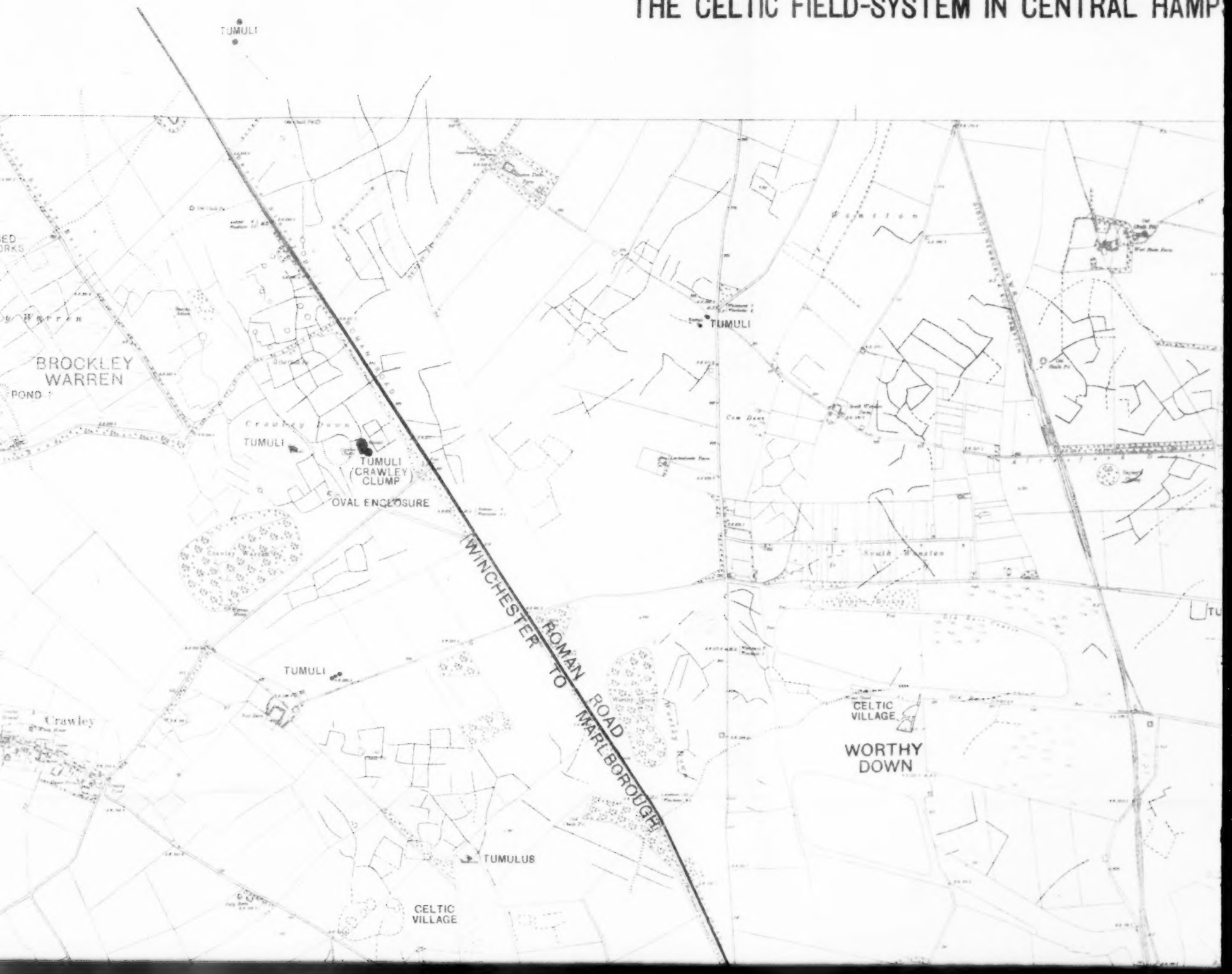
Sixth Afternoon Meeting, 16 April 1923.—The President in the Chair.

Paper: The Salts of the Dead Sea and River Jordan. Wilfred Irwin.

SCALE 1 : 20,000.

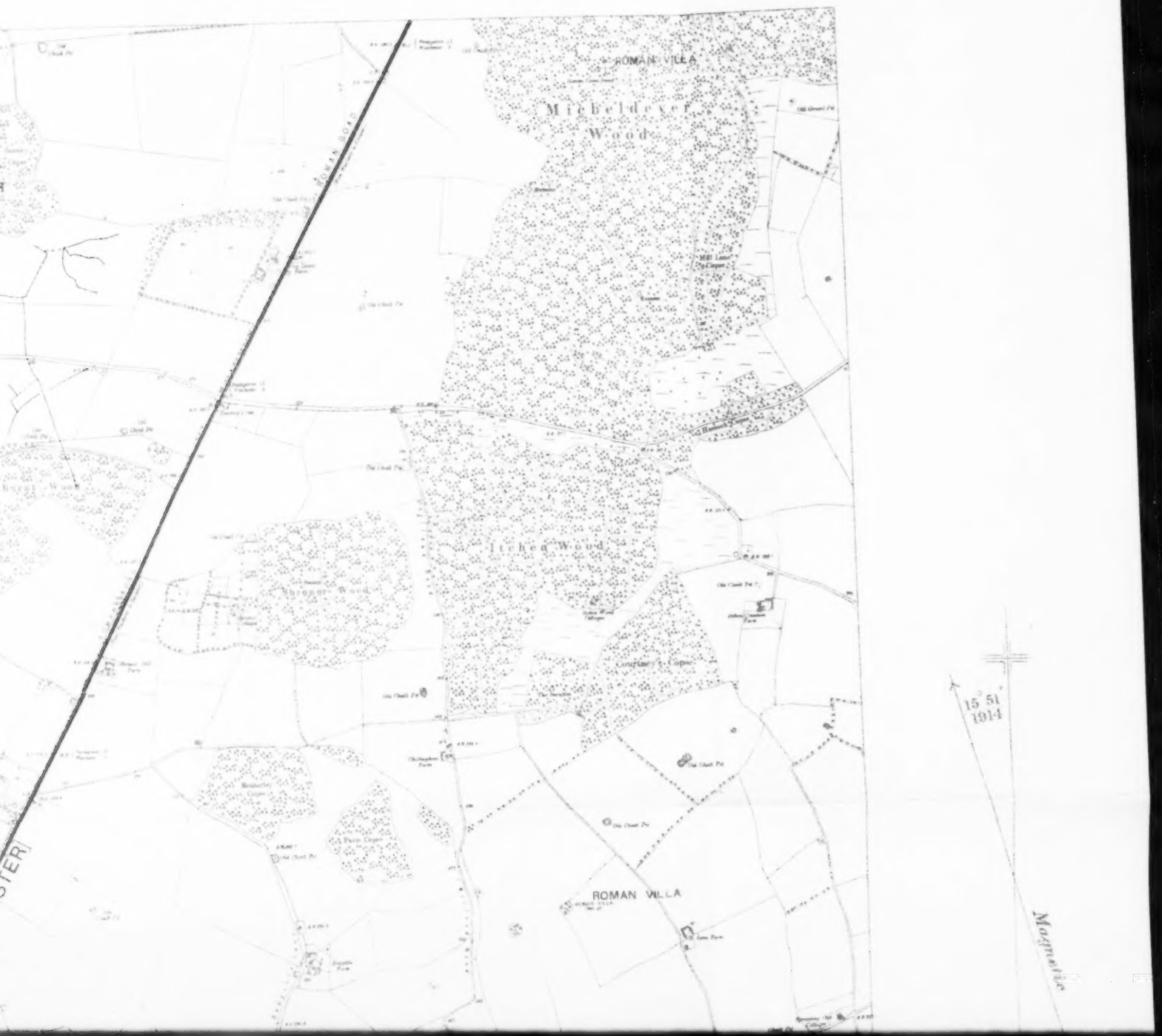


THE CELTIC FIELD-SYSTEM IN CENTRAL HAMP



IC FIELD-SYSTEM IN CENTRAL HAMPSHIRE AS REVEALED BY AIR-PHOTOGRAP

RAPHS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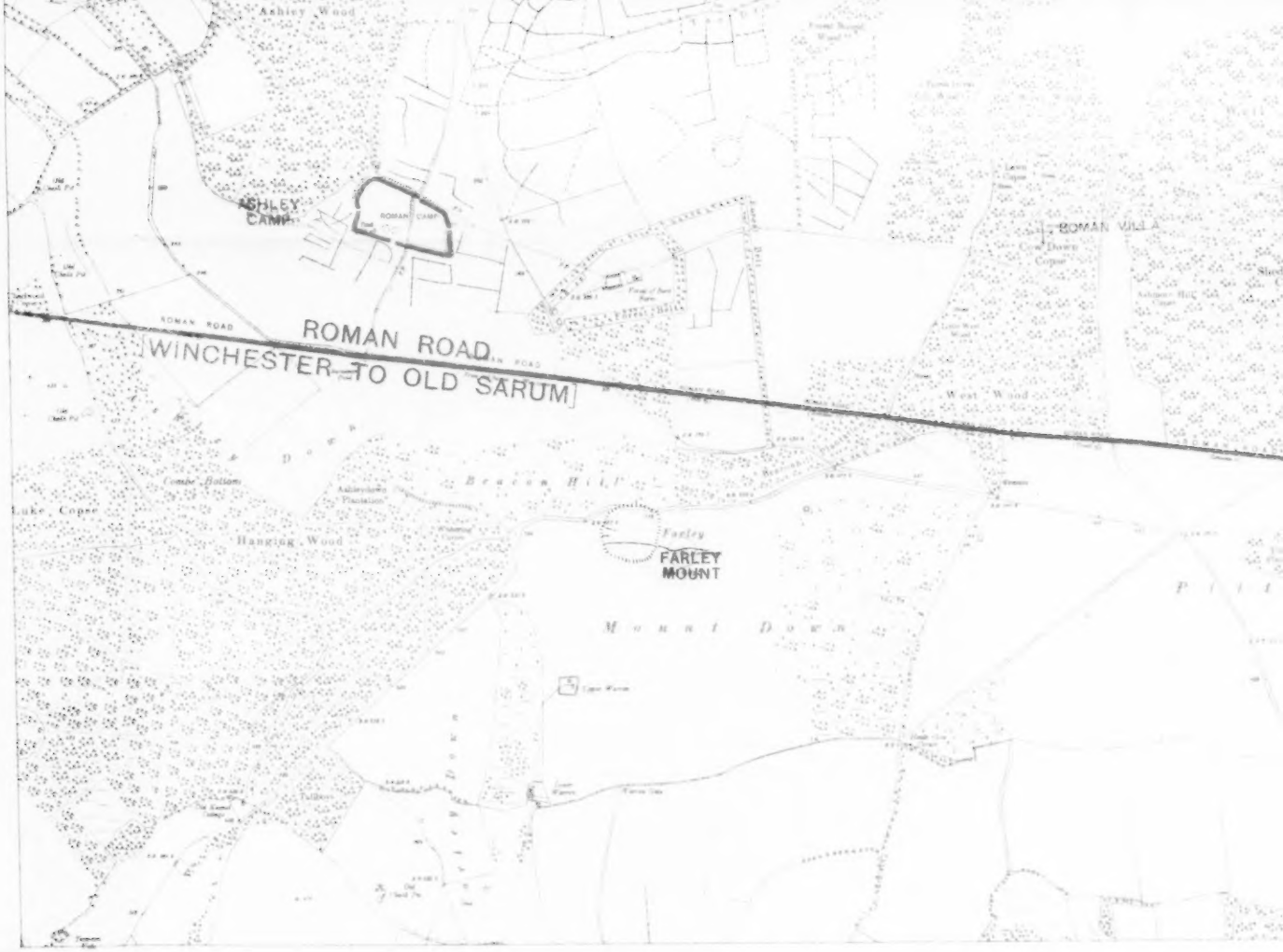
Itchen Wood
Shrogger Wood
ROMAN VILLA
15° 51
1914
Magnetic

Ridge Grove
Winter Down Copse
Little Somborne
SITE OF
ROMAN BUILDING
(Roof-tiles etc.)
Ashley Wood
ROMAN CAMP
ROMAN VILLA

TUMULUS
CELTIC
VILLAGE
Littleton
Harmont
Sparsholt
Weeke

TUMULUS
CELTIC
VILLAGE
Littleton
Hurstwood
Weeke
Ashley Wood

SITE OF
CELTIC VILLAGE
ROMAN ROAD
(WINCHESTER TO SILCHESTER)
ROMAN VILLA
Martyr Worthy
Itchen Abbas
Arrington
Easton



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Yards 1000

Scale 1:20,000

Metres 10

Winchester Golf Course
Crab Wood
Teg Down
Royal
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WEST HILL
ROMAN ROAD
Yards 1000 500 0 1000 2000 3000 4000 5000
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Weeke
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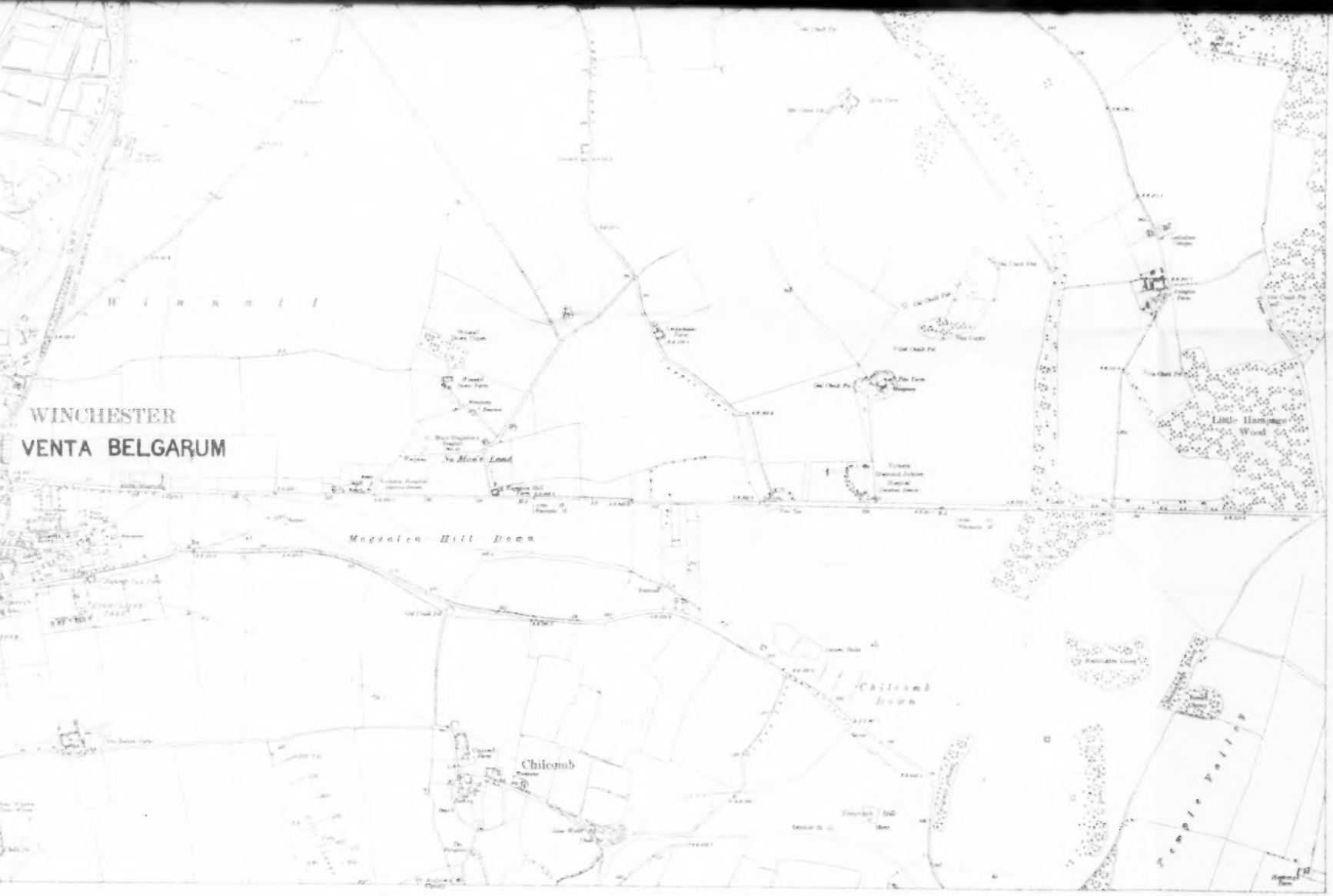
WINCHESTER
VENTA BELGARUM
Winnall
Magdalen Hill Down
Chilcomb
Chilcomb Down
Little Hamptage Wood
Roman Palace
Ordnance Survey 1923
7000 8000 9000 Yards
6000 7000 8000 Metres